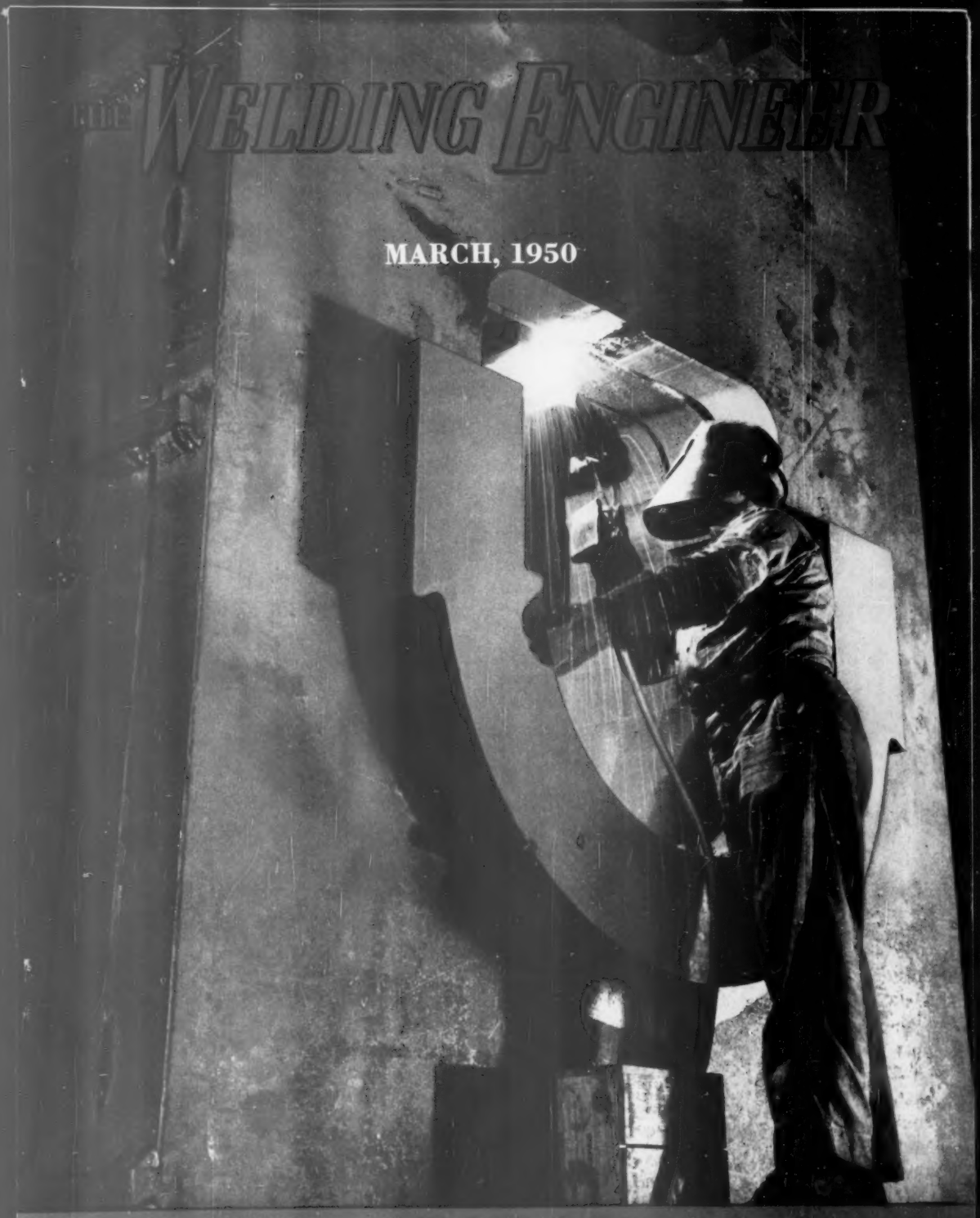
THE WELDING ENGINEER

MARCH, 1950



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Look closely at this conductor. Notice the hundreds of fine individual copper wires. Belden strands together 5355 of these electrolytically pure copper wires to make this one size 4/0 conductor. This makes the cable more flexible... easier for you to use.

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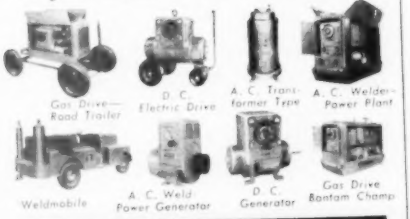

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THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

A McGRAW-HILL PUBLICATION

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AO recommends the 5X163 glove illustrated for protection on gas welding and the heaviest amperage electric welding. Hands and fingers have the freedom and comfort they need for the job because the chrome-tanned leather, while made to withstand hard wear, is soft and flexible. Your nearest AO Safety Products Representative can supply you.

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5. *Extreme earth abrasion*
6. *Corrosion and heat*

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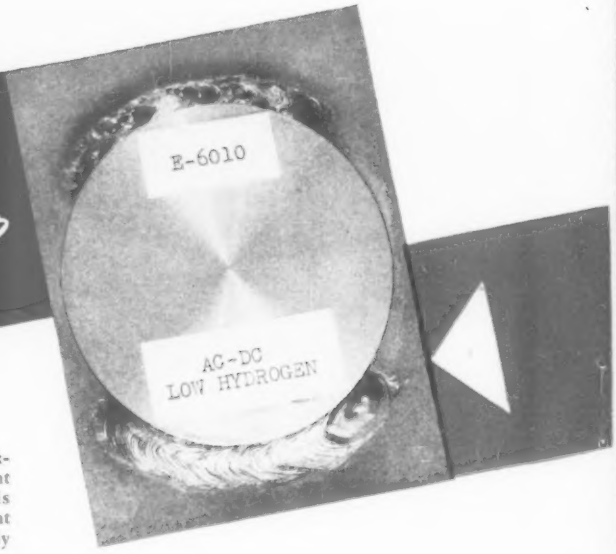

1. Fewer structural failures from underbead cracking—Ordinary electrodes deposit a large amount of hydrogen in weldments on hardenable steel. This produces underbead fissures *not* generally apparent in routine inspection, which in turn causes early structural failures in service. General Electric *low-hydrogen* rods have a special coating which materially reduces the amount of hydrogen deposited, thereby largely eliminating the basic cause for such failures.

2. Better mechanical properties—Laboratory comparisons between these low-hydrogen electrodes and class E6010 electrodes show the former to possess higher tensile and yield strength, better elongation, and *higher impact* at both room and sub-zero temperatures.

3. Welds can be successfully enameled without heat treatment—as has been actively demonstrated on both a laboratory and production basis.

4. Materially improved operating characteristics—G-E low-hydrogen electrodes are extremely flexible in application, with either a-c or reverse polarity d-c; spatter is minimized, deposition efficiency is high, penetration is adequate but not excessive. There is little or no tendency for surface holes to occur in metals of relatively high sulphur content—and in all cases the finished weld offers an excellent appearance. (Note lower bead in photo above.)

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W-60, W-61, W-62 are three new additions, with recommended applications as follows:

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W-61—For a wide variety of low-alloy, "high-tensile" steels.

W-62—For use on steel castings and for producing weld deposits having high impact properties at subzero temperatures.

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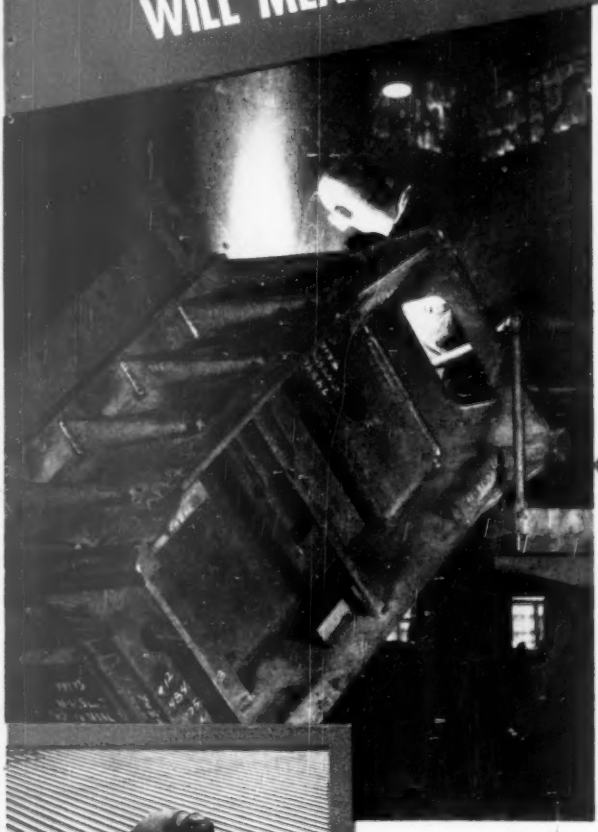
HERE'S WHY G-E LOW-HYDROGEN ELECTRODES WILL MEAN MONEY IN YOUR POCKET



HERE'S WHAT USERS FIND WITH G-E "LOW-HY" ELECTRODES

Production had virtually stopped at a Pennsylvania machinery manufacturer's plant because cracks were developing in weld-fabricated steel parts. A rush shipment of W-32 from our Philadelphia distributor eliminated the cracking and had them back in production the same afternoon.

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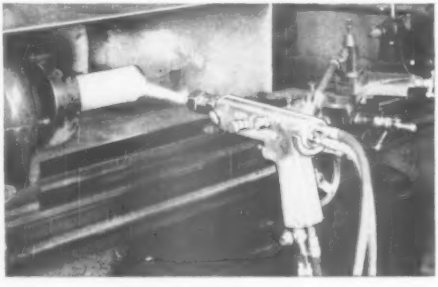

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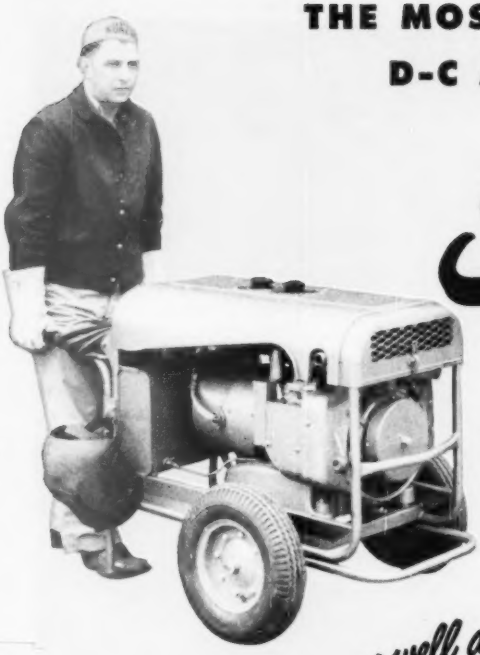

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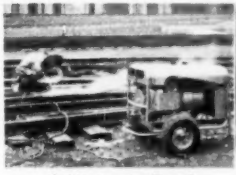

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Watch out for the "Easiest" Way

YOU CAN DO ANYTHING in either of two ways—right or wrong. And some little known law of the universe seems to decree that the easiest way to do a job usually turns out to be the wrong way. Perhaps you have noticed that interesting fact, too.

As a practical instance, I saw a couple of weldors trying to do a job the easiest way and coming up with the wrong answer. First of all, they were reluctant to take the time to measure the piece of metal they were cutting. They thought their eyes could tell "good enough to get by." There was a flame-cutting job on a guess-and-by-gosh basis. Both guesses were wrong. The first cut resulted in a piece that was too long, so it was cut again—still without measuring—and the piece came out too short. The joining was then accomplished by "slugging" in an electrode and welding over the too-wide gap. A neat piece of work all around!

The "easiest" way was the most costly. There was twice as much flame-cutting as necessary and probably twice as much welding. It is unnecessary work of this character that helps to price welding out of the picture. Doing a job over to make it cost twice as much will not put welding into competition with anything but the National Debt. Sloppy workers should be made to realize that they are gradually working themselves out of a job.

Welding has long been noted for offering certain basic advantages. In the fabrication of metal goods, these are: (1) lighter weight; (2) greater strength; (3) more pleasing appearance and (4) lower cost. It's darn hard to beat that combination of four aces—yet some weldors are managing to throw them all away by their lack of careful workmanship.

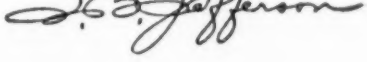
Everyone engaged in any welding activity ought to take pride in his work. To do them justice, most weldors do. They are happy to be in welding and are proud of the better way of life that welding has made possible to all of us in the United States. There are always the inevitable few, however, who lack this natural pride in turning out a first-class job. With them anything goes—the less work the better they like it. They are natural members of the "something-for-nothing" class.

The something-for-nothing boys are milking this country as if the old cow would never run dry. The papers tell me that 15,830,899 checks are being sent out each month from Washington for old age pensions, benefits, subsidies and just plain handouts. One out of each six adult Americans apparently receives a monthly dole from the Great White Father. If every one of the 15,830,899 checks goes to a different family, 42.7% of the families in this country—perilously close to half—are receiving government support. Is it any wonder that our income taxes are still at wartime levels? Or that the government is continually operating under a deficit.

Particularly among the sloppy workers is the sentiment marked for more "free" things. In his magnificent essay on Compensation, Emerson once pointed out that it is better for a man to break his own bones than to promote rides in his neighbor's carriage. He has a good point there because the man who has lost his own self-respect has lost everything that makes life worthwhile.

And in the long run, there's nothing really free unless it's the air we breathe. Somebody always pays for the something-for-nothing programs. That includes pension plans, whether they are private or Federal, paid for entirely by the management or contributed to by workers. In any case they are forced savings—somebody's savings. As a nation, we are going to get it in the neck some day if we don't get over these weird ideas of perpetual-motion economics.

By the same token, many weldors are pricing themselves out of jobs by not giving an honest day's work for an honest day's pay. The easiest way is the hardest way for the long, long pull.



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PRESSED PIECES of "Plexiglas" aided design of Icosasphere. Spherical shell sections above flatten when reheated

Icosasphere Saves Steel

LESS SCRAP LOSS: New-type layout for spherical tanks saves 700 sq ft of 1⅝-in. plates—19% of the steel required to build tank of 28.75-ft ID by the conventional orange-peel layout. That represents a saving of 46,300 lb of steel.

FEWER FEET OF WELDED SEAMS: In the same size spherical tank, an Icosasphere needs 122 ft less seams than the conventional design, which means a reduction of 20.7% in welding.

BY J. O. JACKSON
Vice-President, Engineering and Research, Pittsburgh-Des Moines Steel Co.

SPHERICAL tanks are economical for pressure storage because that shape most effectively resists internal pressure and because the area of shell per unit of volume is less than that of any other shape. On the debit side, however, is the rather large amount of scrap or waste material involved in the fabrication of spherical tanks from rectangular plates.

We in the research department of the Pittsburgh-Des Moines Steel Co. have developed a method of designing and building welded spherical tanks and other double-curved plate surfaces which can considerably reduce both scrap loss and welding. If you don't mind a little solid geometry, I'll do my best to explain.

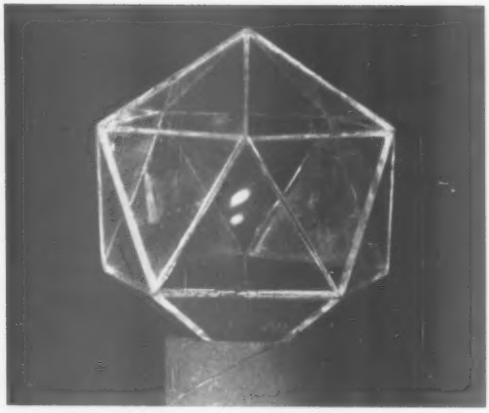
Must Predict Plastic Flow

In order to improve the plate layout of a double-curved surface such as a sphere, we must be able to predict the size and shape of the flat plates which are "dished" to form specified portions of the double-curved surface. It is impossible to determine the flat shape by either mathematical or drafting methods because plastic flow is involved. That shape, however, may be determined experimentally by the "rubber cube" method.

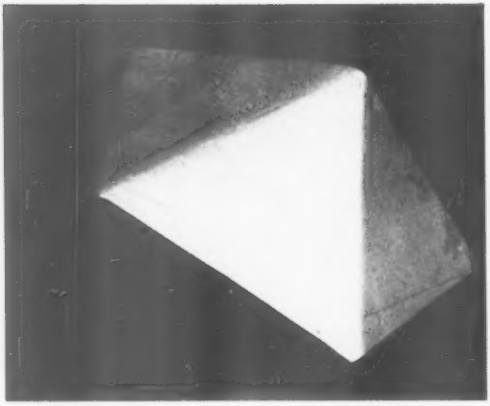
Imagine rectangular plates laid out on the sides of a rubber cube circumscribed by a sphere. The cube is then expanded, say by blowing air into it, until its faces touch the spherical outer shell—in other words until it has been transformed into a sphere itself. In expanding the cube to fit the sphere, all of the flat plates making up its six faces have naturally become curved.

This gives us the clue to our new method of predicting plastic flow. Essentially, it consists of forming the desired object of a suitable plastic material, which is softened by heat and allowed to cool between dies to restrain it to the desired curved shape. The edges of the piece are then trimmed to the outline required, after which the trimmed piece is "relaxed" by heating it to the softening point, when it will flatten and assume the outline of a properly shaped flat piece.

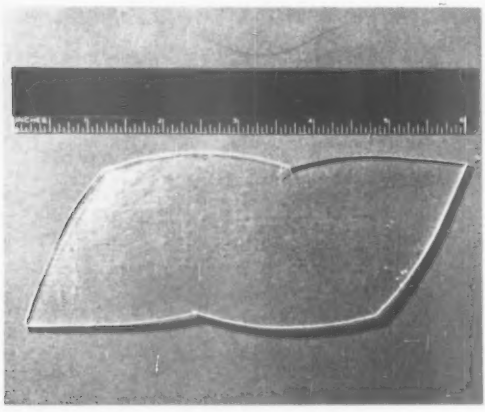
The shape may be determined with sufficient accuracy for layout studies by the use of thin sheets of methyl methacrylate known as "Lucite" or "Plexiglas." These are plastics with a memory; they can never quite forget what they once were. To illustrate, the material when manufactured is formed into sheets by polymerization (building up of large molecules) between two glass surfaces. The Lucite or Plexiglas sheet, being thermoplastic, may be



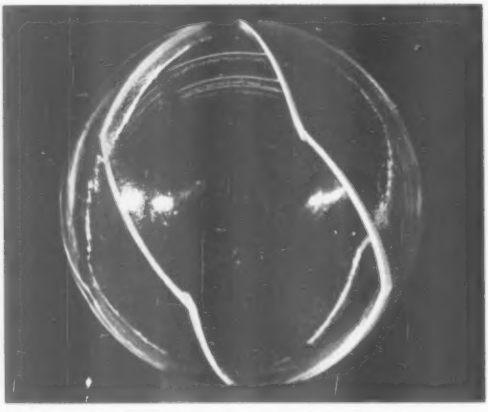
1 DESIGN STARTS with Plexiglas model of an icosahedron, a polyhedron having 20 triangular faces



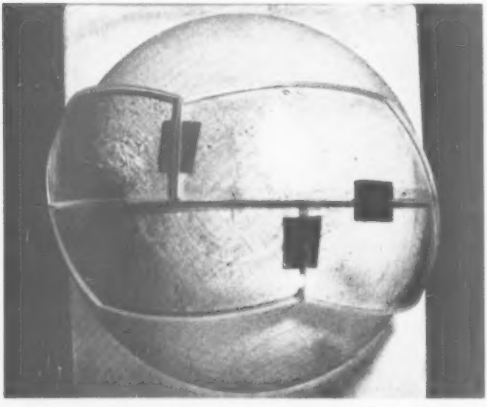
2 BENT PARALLELOGRAM from icosahedron. Five such units will form a complete icosahedron shell



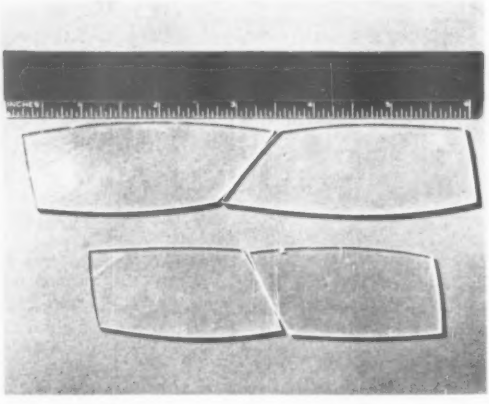
5 RELAXED by reheating, parallelogrammic unit of Fig. 4 flattens into a pattern for plate layout



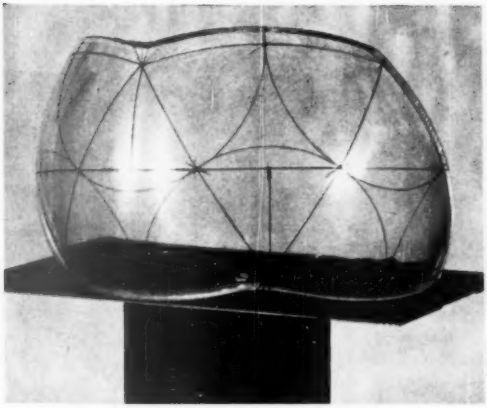
6 SHELL OF SPHERE may be composed by joining together five of the parallelograms of Fig. 4



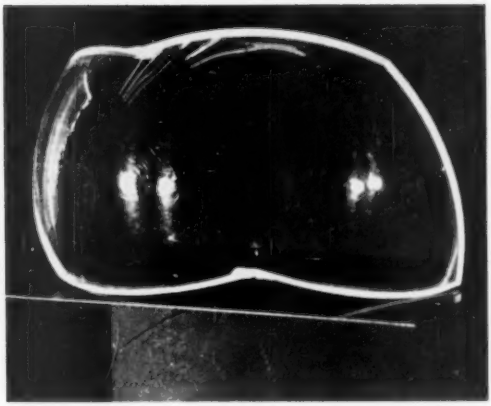
7 LARGER SPHERES are divided into five sections, each of which is subdivided into four basic parts



8 RELAXED developments of Fig. 7. The four units are arranged as they will be cut from steel plate



3 SPHERICAL TRIANGLES outline a parallelogram like that of Fig. 2 but with the proper curvature



4 TRIMMED, the parallelogrammic unit of four triangles becomes the spherical equivalent of Fig. 2

Evolution of the Icosasphere is shown by plastic models at eight stages

heated and re-formed into almost any shape, and it will retain its new shape if it is allowed to cool while it is being restrained by dies or forms. If the new shape is again heated, however, and allowed to cool while unrestrained, it will "relax" or return to the shape in which it was originally polymerized.

This is a highly useful property. It can be very valuable for the determination of the particular flat shape which we want to form by plastic flow into a section of the desired curvature.

We Work Backwards

As an example, let us heat a Plexiglas sheet and form it to a portion of the surface of a sphere. To do this we will need a mold—say two concentric hemispheres which hold the plastic sheet between them as it cools. On our new curved surface of plastic, we scribe an equilateral triangle by connecting three equidistant points with arcs of great circles. This sounds harder than it is; the arcs may be simply drawn by placing the curved sheet in a cylindrical shell having an ID identical to the OD of the sphere. When any two of the points on the spherical section are in line with the circular end of the cylinder, a curved line is traced to connect them, using the end of the cylinder as a "rule" or template. The curved line will be the arc of a great circle. The spherical triangle may be sawed or otherwise cut out. It is then heated on a flat surface until it softens, when it will assume the "relaxed" flat surface shape — exactly what we were looking for. Our method, you will see, is to work backwards: take a desired section of a spherical surface and see what we get when it flows plastically to become flat.

A word of caution: it is usually advisable to cut out another flat piece slightly larger than the one first relaxed, dish it, lay it out, trim it and reflatten it with heat since the stretch of the material will be different if the original piece was much larger than necessary. When a piece has been properly made, it may be dished and flattened many times without appreciable change in shape. Of course the method of dishing should be similar to that to be used for the steel plates so that the plastic flow will likewise be similar.

The process we have just described is applicable to any formed work where plastic flow is involved: spherical tanks, wind tunnel flares, nozzles, contraction pieces, hemispherical, elliptical and toroidal tank bottoms and any other dished, pressed, drawn or warped plate work.

Orange-Peel Layouts

Our first application of the method was to determine the shape and arrangement of plates to form a spherical tank shell with a minimum amount of scrap loss and a minimum number of feet of welded seams. Spherical tanks are made with several plate layouts, most common of which is probably the "orange peel" design. This usually consists of a top and bottom "saucer" with one or more courses of approximately vertical plates in between. The vertical plates are wider near the center of the sphere and taper towards the top and bottom so that they resemble orange peels. Since these plates are tapered, two of them can be cut from one rectangular plate to reduce the scrap. When this is done, however, the finished sphere plates are much narrower than the economical width so that there is a considerable increase in the footage of welded seams required over the footage required when only one sphere plate is cut from each rectangular plate. If plates of maximum width are cut singly to form the separate plates, the amount of scrap is excessive. There just isn't any way of escape from between the horns of this dilemma unless we abandon the orange peels.

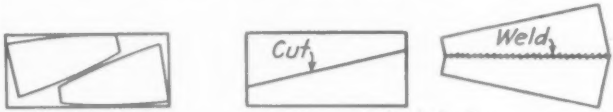
In the study made by the plastic model method, several types of plate layouts were considered, were quickly made on the dished plastic, relaxed, and the shape of the relaxed plates measured to determine the most economical layout.

Let us now return to our imagi-

Table I. Material and Seams Required by Different Layouts

Layout	No. of Plates	Ordered Excess[1] Sq Ft	Ordered Excess[1] Per Cent	Feet of Seam
10-Ft Diameter Spheres				
1. Icosasphere	5	57	18	83
2. Orange Peel[2]	6	125	40	96
3. Cube Layout	6	62	20	70
20-Ft Diameter Spheres				
4. Icosasphere	20	221	11	423
5. Orange Peel[2]	12	670	34	362
6. Orange Peel[3]	32	447	23	600
7. Cube Layout	18	367	19	420
50-Ft Diameter Spheres				
8. Icosasphere	48	888	11	1,418
9. Orange Peel[2]	40	3,460	44	1,548
10. Orange Peel[3]	50	1,609	21	1,903
11. Orange Peel[4]	32	860	11	1,058 (shop) 1,265 (field) 2,323 (total)
12. Cube Layout	30	1,224	16	1,279

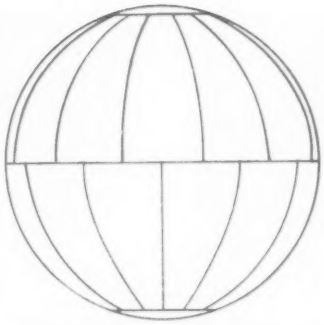
Notes: [1]Ordered excess is area ordered less area of sphere, expressed in square feet and in per cent of sphere area.
[2]Plates cut one sphere plate from one rectangular plate.
[3]Plates cut two sphere plates from one rectangular plate per sketch A.
[4]Plates cut diagonally in half and rewelded in shop as per sketch B.



Sketch A Sketch B

Table II. Comparative Costs of Two 28.75-Ft Spheres

	Orange Peel	Icosasphere
Steel, delivered to shop at 3.0c per lb	$ 7,290	$ 5,900
Less credit for scrap at 1.0c per lb	695	231
Net cost of steel	6,595	5,669
Fabricating cost and shop overhead	2,950	2,540
Freight (say 50c per cwt)	865	865
Erection	5,960	5,100
Total cost	16,370	14,174
Overhead and profit, 15%	2,455	2,126
Total price	$18,825	$16,300



9—ORANGE-PEEL plate layout for spherical tank of 28.75-ft ID

nary rubber cube, which, you will remember, we thought of as being blown up until it conformed to the spherical shell. The cube is not the only geometrical shape which would serve for this purpose; any regular polyhedron would do as well or better. A regular polyhedron, in case you don't remember, is a something whose faces are regular polygons: the equilateral triangle, the square, the regular pentagon, the regular hexagon and any other polygons whose sides are equal and form equal angles. The Big Five of the regular polyhedron world are the tetrahedron or pyramid with four triangular faces, the hexahedron or cube with six square faces, the octahedron with eight triangular faces, the dodecahedron with twelve pentagonal faces and the icosahedron with twenty triangular faces.

Icosahedron and Icosasphere

For our purpose, the icosadedron (twenty triangular faces) would seem to offer the most interesting possibilities. The icosahedron may be built without scrap loss, for the triangles may be alternated and cut from rectangular plates without waste. Four adjacent faces of an icosahedron may be flattened into a parallelogram. Five such parallelograms will form the entire surface of an icosahedron. These facts suggest that from the standpoint of scrap loss, the best possible plate layout for a spherical shell would be to form it of five parallelogrammic units, each of which represents four adjacent triangular faces of the icosahedron expanded into a spherical surface. A good name for a sphere laid out in this fashion would seem to be the Icosasphere.

The Icosasphere is, then, a sphere laid out along the expanded lines of four adjacent faces of an icosahedron. Five plates cut the proper shape and dished will form a complete sphere. These plates may be cut from one rectangular plate with remarkably small scrap loss. As the size of the sphere increases, it becomes necessary to subdivide its five parallelogrammic units, and designs have been prepared based on subdividing each side into two, three, four and eight subdivisions.

Table I shows the excess steel that is required to be purchased—expressed both in square feet and as a percentage of the area of the sphere—for three sphere diameters, 10, 20 and 50 ft. and five types of layouts: icosasphere, cube and three types of orange-peel spheres. This same table also compares the number of feet of joints (usually welded joints) required for each type of layout and for the three sphere diameters. If the cost per foot of joint is added to the cost of scrap for any assumed thickness of the various layouts, the most economical

10—ICOSASPHERE of a 28.75-ft ID. Compare layout with Fig. 9

layout for a sphere may be determined.

Forming the Spherical Shell

The plastic method previously described was applied to development of the layout for the Icosasphere. Fig. 1 illustrates a Plexiglas model of an icosahedron, the 20-faced polyhedron, and Fig. 2 shows one of the five bent parallelograms which will form its shell.

A partial spherical shell of Plexiglas was dished and scribed to outline one parallelogrammic unit, as illustrated by Fig. 3. This contains four alternately arranged equilaterial spherical triangles. Fig. 4 shows the parallelogrammic unit after trimming; Fig. 5 the relaxed parallelogrammic unit. In Fig. 6, we see a completed spherical shell composed of five of these parallelogrammic units. The plates forming the shell of the sphere are similar to and are arranged like those forming the shell of an icosahedron; hence the name "Icosasphere."

Careful measurement of the relaxed unit shows that a spherical shell of 4-in. ID may be made from five flat parallelograms 2.32 in. or 1.12R in height by 5.05 in. or 2.43R in length, with additional material needed on the ends to the extent of 1.16 in. or 0.558R, R being the radius of the sphere in inches to the center of the material. If these parallelograms are cut from one long plate, it will be 1.12R wide and 12.71R long $(5 \times 2.43 + 0.558)$. The total area, therefore, will be $14.25R^2$. The area of the surface of a sphere is $4\pi R^2$ or $12.57R^2$. The amount of scrap is the difference—$1.68R^2$ or 11.85% of the amount of material needed.

A steel spherical tank 4 ft in diameter and ¼ in thick was next made with the same plate layout. It was found that the required dimensions of the flat steel plate were substantially the same proportions as the Plexiglas model if the dimensions were expressed in terms of "R," the radius of the sphere to the mid-thickness of the shell. All of the joints in the steel Icosasphere were butt welded from outside, using beveled edges and inside back-up bars.

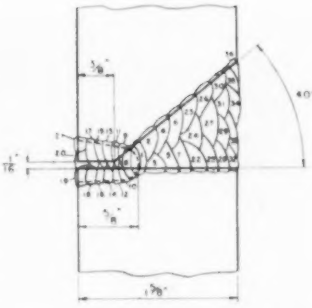
This sphere was designed for a working pressure of 200 psi. It was tested to failure, which occurred at a gauge pressure of 1,150 psi at a calculated unit stress of 49,244 psi. Strain-gauge measurements showed good agreement with the calculated value. Recorded stress-strain curves indicated a modulus of elasticity of 43×10^6, which agrees closely with the calculated biaxial modulus and with previous tests. The test confirmed the belief that there was no inherent weakness in this particular plate arrangement.

Problems of Large Spheres

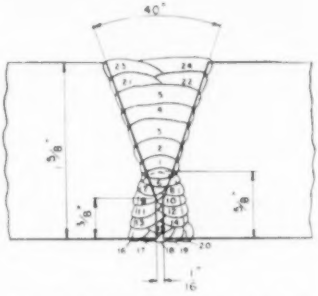
It is usually not economical to employ plates wider than 100 in. in fabrication because of the higher pound cost of the steel and the additional cost and difficulty of handling. Assuming 100 in. to be the maximum width, the largest sphere which can be built from five parallelogrammic units is about 14.8 ft in diameter. For larger spheres, it is necessary to subdivide each parallelogrammic unit into several smaller units.

Fig. 7 illustrates a parallelogrammic unit forming one fifth of the surface of a sphere divided into four subdivisions arranged in their respective positions to form the parallelogrammic unit. Fig. 8 shows the same four subdivisions arranged as they would be cut from rectangular plates. It has been determined by careful measurement that a sphere may be constructed from five plates 0.556R wide and 2.14R long and five plates of the same width and 2.79R long. The total required plate area in square feet is $13.7R^2$, where R is the radius of the sphere in feet. Since the surface of a sphere is $12.57R^2$, the scrap loss is $1.13R^2$ or 8.2% of the required plate area.

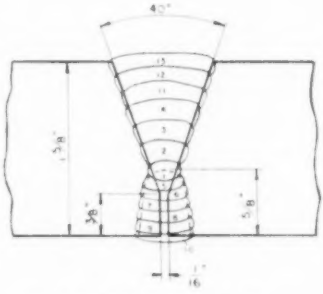
As an example of the application



11—HORIZONTAL seams call for above type of butt-welded joint

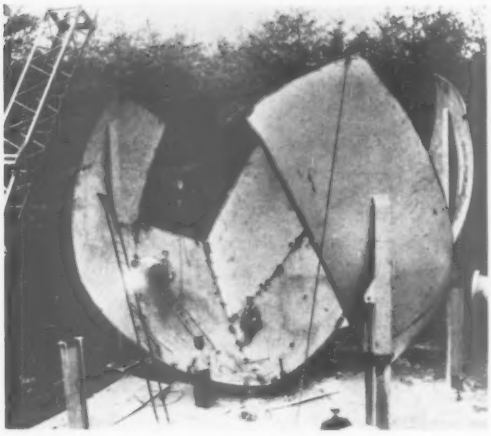


12—DOWNHAND and overhead seams are welded in this sequence

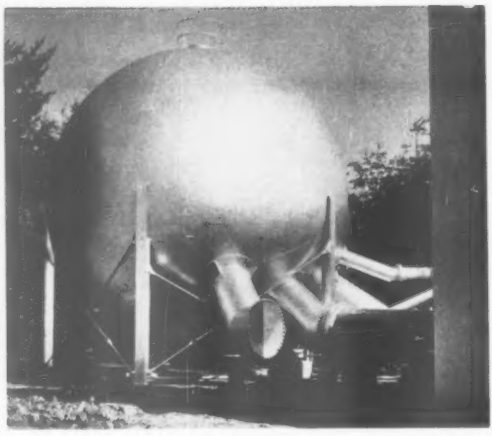


13—VERTICAL joint applies to seams inclined 45 deg either way

of this method to commercial spherical tanks, Fig. 9 shows the conventional orange-peel layout of a sphere 28.75 ft ID formed of 15/8-in. thick plates and designed for a working pressure of 205 psi. Fig. 10 shows the plate layout of an Icosasphere of the same size. The radius of the sphere to the center of the metal (R) is 14.46 ft, the area of metal in the completed sphere 2,620 sq ft, and the weight of the completed sphere 173,000 lb.



14—ERECTION and tack welding of Icosasphere of ID 32 ft 5 in. Only 20 plates are needed for the shell



15—COMPLETED ICOSASPHERE is connected by the large pipes to a supersonic wind tunnel test chamber

The orange-peel design requires a total plate area of 3,670 sq ft; the Icosasphere 2,970 sq ft. The orange-peel design requires 590 ft of welded seams; the Icosasphere 468 ft. With 1⅝-in. plates, the 700 square feet less of plate area with the Icosasphere represent a saving of 46,300 lb of steel, which is equivalent to 19% of the steel required for the conventional sphere. The Icosasphere requires 122 ft less of welded joints, which is 20.7% less welding than in the conventional design.

The estimated cost of the two designs is given in Table II. Taking everything into consideration, the Icosasphere effects a saving of $2,525 in the cost of the sphere, amounting to 13.1% of the cost of the conventional sphere.

New Types of Welded Joints

The type of welded joint used is not an essential part of this design method. The type of weld, however, is very important to the economical construction of either type of sphere. It is more economical to butt weld the seams than to rivet them, and leakage or seepage, which is difficult to prevent in riveted joints, is avoided in properly welded ones.

Figs. 11, 12 and 13 illustrate the detail design of the butt welds for horizontal, downhand-overhead and vertical seams, respectively. The joints are used in locations within 45 deg of the positions stated; the vertical joint of Fig. 13, for example, should not be used on a seam inclined more than 45 deg from the vertical, either to the left or the right.

These new-type joint designs are believed to be less costly than previous ones. The plates are prepared by flame-cutting to the heavy outline on the drawings, making a single bevel with a shoulder on each edge. The plates are then tacked together, leaving a space of 1/16 in. between the shoulders. The included angle of the bevel varies with different thicknesses, and the most economical bevel must be determined by tests.

The first continuous welds are placed on the beveled side in the bottom of the vee. After several beads have been welded, the joint is flame-gouged on the back side to remove the shoulders and the imperfect part of the first beads. The back side is next welded, and the front side is then completed in the order indicated by bead numbers.

The joints illustrated were qualified as to process and tested with satisfactory results. The steel used was ASTM A-285 firebox grade "A," and the electrodes were E-6010.

These flame-gouged joints are faster to make and less costly than double-U grooved joints. The principal saving is in plate edge preparation and in the lower cost of flame-gouging as compared with back chipping to clean up the root. Experience has shown that the saving is about 8% for the vertical joint, 16% for the horizontal joint, 24% for the downhand-overhead.

Another advantage of this type of joint is that in the case of downhand-overhead seams, a much larger percentage of weld metal can be deposited in the downhand position.

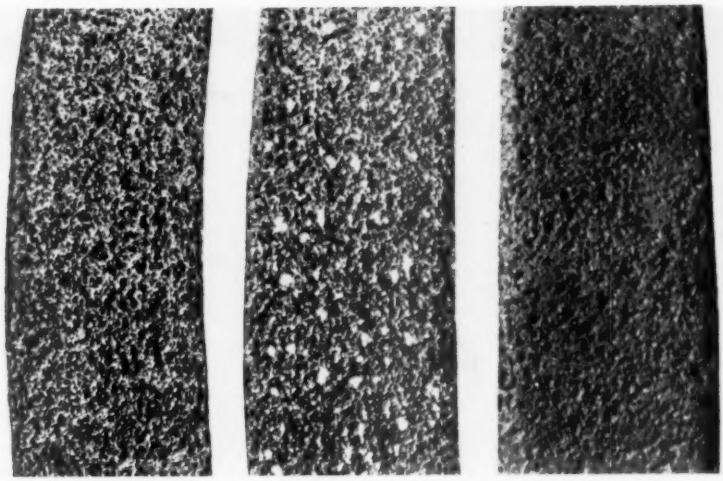
A sphere of 2⅝-in. plates was recently completed using these types of joints. No difficulty was encountered in the field welding after the proper sequence was developed.

Sphere for a Wind Tunnel

Fig. 14 shows the erection and tack welding of the ½-in. plates forming an Icosasphere of 32 ft 5 in. ID to be connected to a supersonic wind tunnel test chamber. The shell, formed of only 20 plates, is supported on five columns. The completed sphere may be seen in Fig. 15. It was erected in a single day, but the welding of the seams took many days.

After completion, the shell was tested to 100 psi hydraulic internal pressure, which it withstood satisfactorily. The shell was designed for an external working pressure of one atmosphere or 14.7 psi. The high internal pressure tests of about 6.8 times the external working pressure of the sphere was for the purpose of removing flat spots and rounding out the surface of the sphere so that it would more effectively resist the external pressure.

The design and construction of the Icosasphere is covered by patent applications owned by the Pittsburgh-Des Moines Steel Co.



SHARP *LOADED* *GLAZED*

What Causes Glazing and Loading?

A grinding wheel may be loaded or it may be glazed. The result in either case is lack of cutting efficiency, but the two conditions are by no means the same. Here's how to distinguish between them

What causes loading?

The face of the "loaded" grinding wheel is filled with particles of the relatively soft or ductile metal being ground. Obviously, when the pores or spaces between the cutting grains are filled, effective cutting is impossible since there is no clearance for the chips being removed by the grains. An additional disadvantage of a loaded wheel is that it will generate much heat and is liable to burn the work if the condition is not corrected.

What causes glazing?

The glazed wheel is entirely different. Instead of the pores being filled up, the cutting grains have become dull through wear. This unfortunate condition will come about sooner than it should when the bond does not fracture or wear away fast enough to release the dull abrasive grains and expose new sharp ones to the work. Examination of the wheel face shows it to be very smooth, often to the point of a shiny appearance.

A newly mounted or a freshly dressed wheel will have a clear, sharp cutting face. The exposed abrasive grains present sharp points or edges. These may be compared to the teeth on a milling cutter. The space between the cutting points provides the necessary clearance for the minute chips removed in grinding, which normally are thrown off as the wheel rotates.

When a wheel has become loaded or glazed and the condition is not corrected, frequent dressing is needed in order for the wheel to cut freely. Obviously this is both wasteful and time-consuming and increases the total grinding cost.

To avoid loading—

Loading in a grinding wheel can usually be traced to the use of a wheel either too hard or too fine for the job. This is particularly true where the metal being ground is relatively soft or ductile. To avoid it, use a softer grade wheel, which will wear down more readily and thus require less frequent dressing, or a wheel of coarser grit to provide more chip clearance. If wet grinding is being done, make sure that the coolant flowing to the wheel is not gummy or dirty.

To avoid glazing—

Glazing indicates that the bond in the wheel is not breaking down properly for one reason or another. The cause may be in the wheel itself or due to the dressing or to incorrect usage. If in the wheel, a softer grade or a coarser grit size may correct the trouble. If the wheel is right, try a coarser dressing to open up the cutting face. In facing, the proper wheel pressure and wheel feed will also help the bond to break down. If you are grinding wet, be sure that the coolant is neither too oily nor inadequate in amount.

To insure best cutting—

It is important to select the correct grinding wheel for the job and also to operate it at the correct speed in order to insure maximum wheel life. It is important to employ the correct grain and grade of grinding wheel for each job, and it is equally essential to operate the wheel at the proper speed, grinding pressure and feed. Dressing technique must also be carefully considered if the wheel is to last longer between dressings.

Pictures courtesy of the Norton Co.

1—SMALL FOLK of the neighborhood derive many happy hours of healthy outdoor fun from their arc-welded "Go-Around." It is simple to build and keeps them off the streets. Photos opposite show main construction details

Is Business Slack?

If you have children of the "tot" age, make them a "Go-Around" in your spare time. Mr. Sanders tells you how in this article.* Other families in the neighborhood will undoubtedly want one. Soon you have built up a new line of profitable business for your job shop

BY GEORGE S. SANDERS

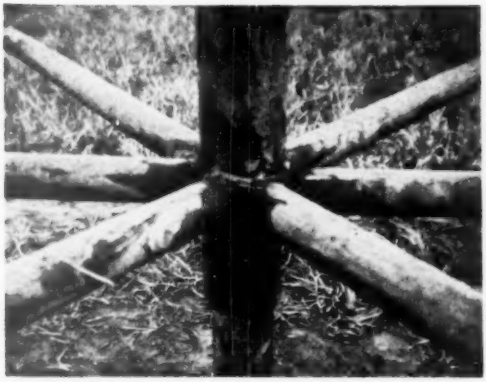
MANY communities have little or no playground equipment for children. Without such a focus of interest, children tend to stray from the intended play areas and very often become injured. Playground equipment keeps them happy, busy and off the streets.

It is my purpose to describe in detail how a "Go-Around" may be constructed economically from scrap water pipe. I am indebted to my two-year-old daughter for the name "Go-Around." What it is is shown in Fig. 1, an apparatus which revolves in either direction about a stationary shaft. The children sit on it and propel it with their legs. There is no question in my mind as to the enjoyment our youngsters derive from it. Whenever the children are outside, one can be assured that their Go-Around is being used.

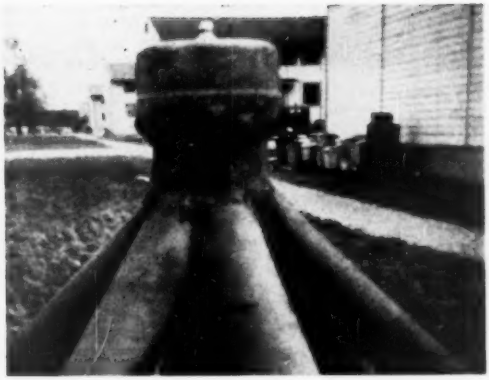
Materials needed for the construction are listed in Table I, and their costs with new materials are estimated in Table II. By utilizing scrap, we succeeded in reducing the material cost to $12.

The principal material item is piping. Table I shows that we will need eleven pieces of piping ranging

*Acknowledgment is made to The James F. Lincoln Arc Welding Foundation for permission to use the pictures and information from a paper submitted by Mr. Sanders in a prize contest.

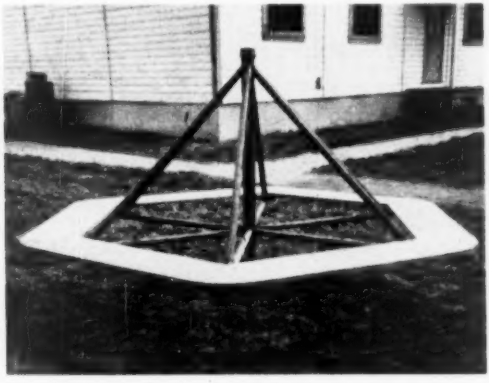


2—JUNCTION of the six 1-in. horizontal pipes with the revolving center post, an extra-heavy 2-in. pipe



3—DIAGONAL BRACES are also 1-in. pipes; they are welded to the center post about 2 in. below pipe cap

4—WELDED FRAMEWORK fits over vertical axle of 1½-in. pipe. Stationary axle is embedded in concrete



5—"GO-AROUND" completed. Board seats are bolted to the radiating horizontal pipes with carriage bolts

Build a "Go-Around"

What You Will Need and What It Will Cost

Table I. Materials Needed to Build a "Go-Around"

No. Req.	Type of Part	Specifications
1	Pipe	2-in. diam by 4 ft long, extra strong
1	Pipe	1½-in. diam; length 64 in. + H*
3	Pipes	1-in. diam by 98 in. long
6	Pipes	1-in. diam by 43 in. long
1	Pipe cap	2 in.
1	Holding rod	½ in. by 13 ft long
2	Planks	1 by 10 in. by 12 ft long
6	Boards	1 by 6 by 10 in.
12	Pipe hangers	1 in.
24	Bolts	¼ by 1½ in. fin neck, carriage bolt
1	Bearing	2 in.
1	Spindle	1½ in. by 1 11/16 in. overall, shaft 9/16 in. diam by 11/16 in. long
1	Bushing	2 5/16 in. diam with hole 1 3/8 in.

*H equals the height of the seat above the ground.

Table II. Estimated Costs with New Material

Welding at $0.25 per junction	$4.50
Piping	
Pipe, 2 in.	2.00
Pipe, 1½ in.	2.10
Pipe, 1 in.	9.20
Pipe cap, 2 in.	0.70
Rod, concrete reinforcement	1.00
Miscellaneous	
Lumber	3.50
Bolts	0.50
Spindle	1.50
Bearing	6.00
Total	$31.00

in diameter from 1 to 2 in. and in length from 43 to 98 in. The stationary upright support is a 1½-in. pipe embedded in a concrete base and extending 30 in. below ground. Over this axle fits a revolving 2-in. pipe sleeve, 43-in. high, to which diagonal braces and horizontal seat supports are welded. The central 2-in. pipe is threaded for capping by a 2-in. screwed pipe cap. The junction of the diagonals with the upright member occurs 2 in. below the pipe cap.

Each of the six diagonals is a 1-in. pipe, 48 in. long, which intersects the seat framework at a 45-deg angle. The plank seats are supported by six horizontal 1-in. pipes, 43 in. long, radiating outward from their junction with the revolving central support.

Preparing Pipe for Welding

The three 98-in. long, 1-in. pipes are used to make the six diagonals. Each of these pipes is cut at 45 deg at the center, giving two diagonal members with one prepared end on each. The opposite end of each pipe member is also cut at 45 deg to produce a prepared end.

The six 1-in. pipes are ready for fabrication after they are cut to 43 in. The 2-in. pipe is cut squarely to 48 in. in length and is threaded at one end.

The 1½-in. axle or shaft about which the apparatus revolves is cut to a length of 64 in. plus the intended height of the seats from the ground. For safety reasons, a clearance of at least 14 in. must be retained.

The 1½-in. spindle is machined from round stock of cold-rolled steel or other suitable material. A scrap axle or shaft is suitable for this purpose. The spindle is made of such size as to cause an interference fit with the inside of the 1½-in. pipe. Other mating parts are made with clearance for free movement.

The bushing in the pipe cap is machined from brass stock. It is not absolutely necessary that this be constructed since there is enough clearance between the revolving pipe cap and the bearing. Several Go-Arounds being used in our community do not have this bushing, and their operation is very satisfactory.

A grease fitting may be placed in the top of the pipe cap to eliminate the necessity of removing the assembly from the shaft for lubrication.

Fabrication by Arc Welding

Before the diagonals and the horizontal pieces are welded, the vertical 2-in. pipe is marked at 2 in. and 15 in. from the threaded end. Each of the horizontal or compression members is marked at a distance of 34 in. from one end to indicate the outside junction of the diagonal member. With these markings to serve as guides, the pipes are positioned and tack welded. If desired, the horizontal and diagonals may be welded first, and then that combination is welded to the 2-in. pipe. It is important that the horizontal members be exactly 60 deg apart and perpendicular to the 2-in. pipe as shown in Fig. 2.

The junctions are finish welded as shown in Figs. 2 and 3. The webs of the diagonals and the 2-inch pipe join as shown in Fig. 3.

The ½-in. reinforcement rod is now welded to the diagonals. Starting point is measured from the junction of the two 1-in. pipes at a distance of 12 in. along the diagonal. The rod is welded to the diagonal at this point, bent and then extended to the next diagonal. A hammer will aid in bending the rod after each successive weld.

The shaft about which the assembly revolves may now be considered. The spindle is placed on top of the 1½-in. pipe and forced into position. Heating the end of the pipe will aid in force fitting the spindle. A ¼-in. fillet weld is used to fuse the pipe and spindle into a single unit; this must be ground to leave a smooth surface on which the bearing can be placed. The bearing and bearing race then go into position above the spindle.

The axle or stationary 1½-in. pipe is embedded in a concrete base 12 in. in diameter and 32 in. deep. The axle comes within 2 in. of the total depth of the concrete. The welded assembly may now be placed over the axle shaft as shown in Fig. 4.

As soon as the Go-Around is on the shaft, it is convenient to cut and fit the lumber for the seats. The details of this construction and assembly scarcely pertain to the subject of welding. The completed project is shown in Fig. 5. After being painted, the Go-Around is ready for years of faithful service to its small customers.

A portable a-c arc welder was used to weld the various pipe joints. Its operation was satisfactory at a setting of 160 amp and a low voltage.

AWS E-6020 electrodes were used in the fabrication of the welded joints. This type of electrode, designed for flat position and horizontal fillets, is recommended because of the gaps between the members and the small thickness of the pipe. It gives shallow penetration and leaves a smooth bead. To enable all of the welding to be done in a horizontal position, the 2-in. pipe is placed horizontally on two stands and is rotated as each joint is welded. To make the use of the E-6020 electrode more efficient, the diagonal members of the construction can be ground to make a better fit with the horizontal members.

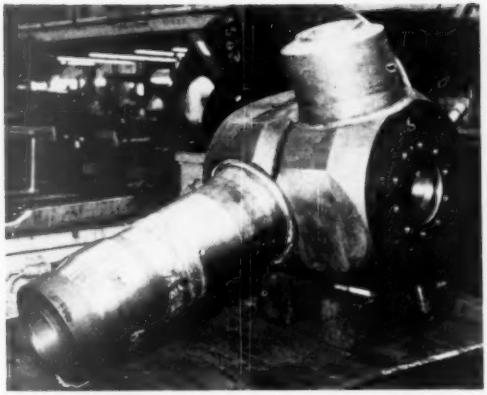
Other Playground Equipment

To insure the safety of children from the sharp edges of mechanical fastenings, welding undoubtedly will become the foremost method of fabricating playground equipment. Some of its possibilities are:

1. Swings;
2. Parallel bars;
3. Seesaws or teeter-totters;
4. Basketball backboard supports;
5. Chairs and tables;
6. Frameworks for sliding boards;
7. Sand box frames for awnings.

A great many advantages result from the application of arc welding. One of the reasons I was able to design and provide our community with Go-Arounds was because of the low cost and simplicity resulting from the application of arc welding. The apparatus built from scrap pipe was strong, stable, safe and easy to construct. Even though the ends of the diagonals were not always cut to fit exactly on the horizontal members, the arc-welded joints were smooth because weld metal filled in the gaps as required.

I wish to acknowledge the aid I received from John Wilson, Frank Wanda, William Wernersbach and William Liebersbach for their labor in helping me to assemble and erect the first complete apparatus. To my wife Janis, I give much credit for the development of this project.



STAINLESS-STEEL turbine throttle valve at right was welded to stainless end of a special transition piece of stainless steel cast on a chrome-moly forging

TRANSITION PIECE made for joining chrome-moly piping to stainless-steel throttle valve. Inset shows plan of uniting the two alloys in a single casting

Joining Stainless to Chrome-Moly

High temperature of 1,050 F at Sewaren, N. J., generating station called for chrome-moly steel piping. Problem was to weld it to turbine throttle valves of type 347 stainless steel having a 50% greater coefficient of expansion.

BY T. B. JEFFERSON

THE country's first power plant to operate with 1,050 F steam, the Sewaren, N. J., generating station of the Public Service Electric and Gas Co. posed many problems for piping experts. In addition to the record high temperature, a throttle steam pressure of 1,500 psi had to be taken into account.

All Piping Welded

The piping systems at Sewaren made the utmost possible use of welding since welded joints and welded fittings are the only type of welded construction capable of standing up under the high pressure and extremely high steam temperature involved. The only flanged joints that are exposed to the 1,050 F steam are those in the steam admission line running between the turbine control valves and the top half of the high pressure turbine casing. The high-pressure boiler feedwater line is all welded. The larger size piping systems carrying salt water are cement-lined steel with welded joints. The 48-in. diam circulating water pipes are made of reinforced concrete — the only part of the piping system lacking in extensive welded applications.

Connecting the boiler and the turbine throttle valve is a 16½-in. OD forged and bored pipe having a wall thickness of 2¾ in. This piping is made of 3% chromium-1% molybdenum steel. The turbine throttle valves are of type 347 stainless steel. The valves and the piping had to be connected, but how?

Welding was the only satisfactory means of joining, but what about the 50% greater coefficient of expansion of the stainless-steel valve over the ferritic steel pipe? The general feeling among engineers was that a welded joint between these diverse metals might prove to be the weak point of the entire Sewaren piping system. The solution of this peculiar problem was one never before attempted. But it worked.

After a complete study of the condition, engineers of the M. W. Kellogg Co., Inc., the fabricator of the main steam and high pressure boiler feed piping, came up with the idea of developing a new type of transition piece. One end of the transition piece would be chrome-moly and the other end stainless steel so that only similar metals would be welded together.

Stainless Cast on Forging

The creation of such a transition piece was no easy job. It was accomplished by the "Kelcaloy" or electric-ingot process, by which the stainless-steel section was integrally cast on a chrome-moly steel forging. A special alloying technique during the casting produced a gradual transition in analysis from one metal to the other. The purpose of this unique arrangement was to have the major portion of the interface between the dissimilar metals longitudinal to the pipe rather than transverse, and therefore subject principally to shear stress as a result of internal pressure or bending forces.

Construction of Sewaren station was authorized with two nominally rated 100,000-kw turbine-generators, completed in 1948. A third such unit was completed late in 1949, and a fourth, of 125,000-kw capacity, is on order for installation early in 1951.

1—MIXED LOAD for preheating. At left, top and bottom halves of pump have casting defects (arrows) scarfed out for welding repair: next are barrel and water pump impeller to be preheated for welding

2—TACK WELDING fitted section of top half of oil-line pump. Bevels were machined. Material is low-carbon steel

Rx: Preheat to

The prescription for welding high-chromium pump barrels is simple: preheat and maintain the preheat temperature. Ingenious rotating fixtures help Byron Jackson Co. hard-face sleeves and other parts

BY FRED M. BURT

PUMP MANUFACTURE

PUMPS SO HUGE that six of them will lift an amount of water more than twice the daily water consumption of New York, Chicago, Philadelphia, Detroit and San Francisco combined are among the products of the large new pump division plant of the Byron Jackson Co. in Los Angeles. The six giant pumps were constructed in conjunction with the Pelton Water Wheel Co., Inc., for the Grand Coulee dam on the Columbia river. Each pump is powered with a 65,000-hp electric motor and can move 720,000 gpm of water from Lake Roosevelt wing dam to the reservoir in the Grand Coulee, an average lift of 270 ft.

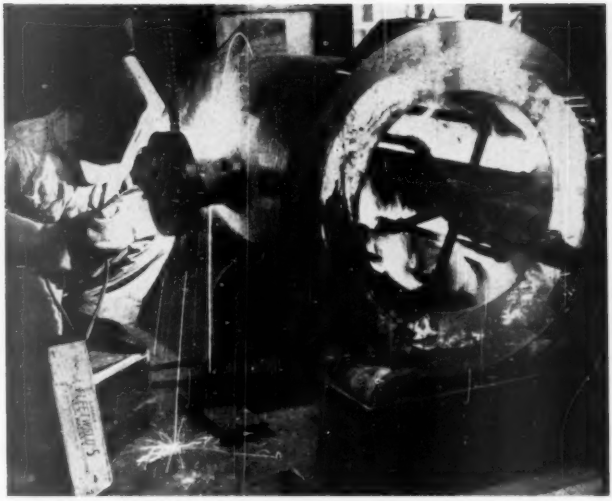
Preceding construction of the Grand Coulee pumps, a working model was built in the Byron Jackson research laboratory; this was required to pump 4,000 gpm against a 270-ft head.

Such giants as the monster pumps of Grand Coulee are not, of course, the only products of the new pump division plant. A wide variety of centrifugal, submersible and turbine pumps are produced, varying from small to huge in size. The enormous pumps for Grand Coulee have suction pipes 14 ft in diameter and discharge pipes 12 ft in diameter. Remember these dimensions to compare with the small discharge and suction nozzles illustrated in Figs. 3 and 4.

WELDING CHROME-STEEL BARREL

The part being welded in Fig. 3 is the outer barrel of a double-case pump. It is made of 11-13% forged chrome steel and must be preheated to and maintained at a temperature above 500 F during all welding. The special burner fixture inserted in the barrel keeps the temperature up during welding. Natural gas and compressed air are delivered to the pipes (which are drilled to serve as a burner manifold) through flexible rubber hoses. This ingenious burner fixture serves only to maintain the temperature, not to obtain it. The preheating is done in a car-bottom furnace fired by natural gas (Fig. 1).

Welding is done with 12% chromium electrodes. First, the four support feet, the end plate and the two nozzles are tack welded. In Fig. 4, the feet have been finish welded, the weldor is finishing the discharge nozzle and the end plate is in the tack-welded stage. In finish welding, the end plate comes last, and the barrel is placed in a well so that the end plate may be in position for



3—HEATING FIXTURE inside barrel maintains preheat of 500 F during welding of discharge nozzle to chrome outer barrel of double-case pump. The electrode carton protects weldor's leg from spatter

4—SUCTION NOZZLE and four feet have been welded; end plate tack welded; weldor finish welds discharge nozzle

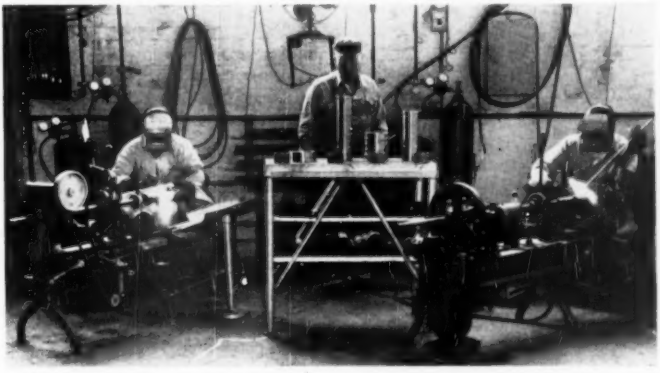
500 F

downhand welding. Two weldors keep about 180 deg apart as they work around the edge of the plate.

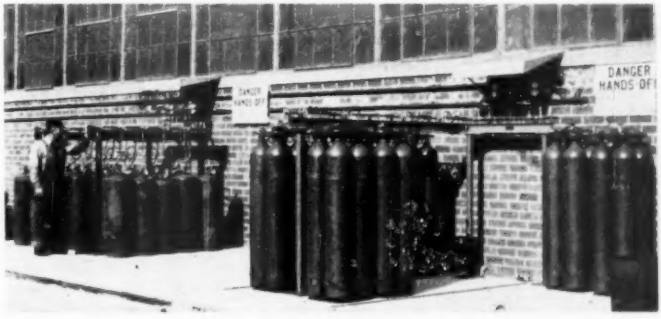
At night, the barrel must be kept up to temperature in the furnace as the total job requires around four days of two-shift welding by two weldors. Before they can start to finish weld the end plate, arrangements must be agreed upon for stress relieving so that the barrel can be delivered to the furnace immediately after welding for stress relieving at about 1,200 F.

Final machining operations such as finishing the face, bore and stuffing box, facing the feet and flanges, drilling feet and flanges, tapping, etc., are done after stress relieving. The pump is then ready to be inspected and tested hydraulically.

A typical service for a pump of this kind is in an oil refinery. This type of Byron Jackson double-case pump has been manufactured for pressures up to 6,000 psi. Three such pumps, each rated at 2,000 hp, work in series to operate a 14,000-ton forging press in Pittsburgh — the world's largest forging press.

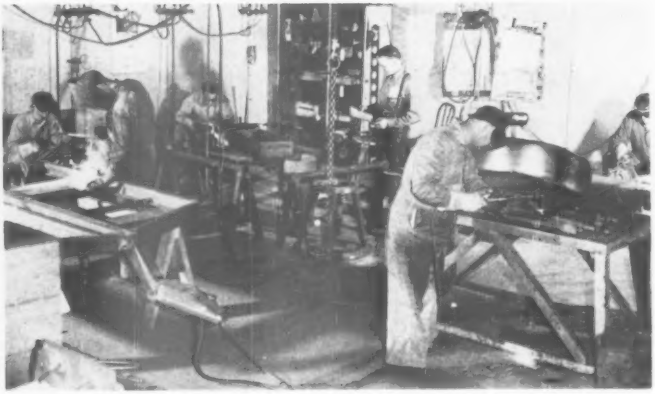


5—ROTATING FIXTURES speed hard-facing of pump sleeves. Other hard-faced pump parts are on the table beside Foreman Mike Kerzner (center)



6—OXYGEN-ACETYLENE storage for pump division welding department is outside. A green pipe line leads from the oxygen, red line from acetylene

7—TUNGSTEN-CARBIDE is applied to each edge of a rock bit cutter by Welder Edward Walters



8—UNDERFRAME of compressor trailer is arc welded at company's No. 2 plant by Welder Elwood Anderson in the left foreground; man at the right, Welder Marvin Fittinger, is flame-cutting an apron to be welded to fender

These particular pumps deliver 1,500 gpm at 6,000 psi — also a world's record.

Instead of chrome steel, some Byron Jackson pumps are manufactured with barrels of low-carbon steel. Since they might be used to supply boiler feedwater or do other jobs where protection against corrosion is needed, overlays of 18-8 stainless steel are applied to the cover fit and volute case areas. These overlays are applied prior to the tack welding of feet, end plate and nozzles.

In Fig. 2, the top half or cross-over section of a low-carbon-steel pump for an oil line is being tack welded with E-6010 electrodes. The edges of the three sections fitting together are machine scarfed and carefully aligned before tack welding. The unit is repositioned for downhand final welding.

Hard-faced Pump Sleeves

A large production hard-facing job is the application of cobalt-chromium tungsten alloys to pump sleeves of AISI 410 stainless steel. This is done with an oxyacetylene torch and on a special rotating fixture (Fig. 5). As the sleeves slowly revolve, a deposit about 1/16 in. thick is laid down. The hard-faced sleeves are ground to precision dimensions and finished smooth on external grinders. Sealing rings, stage pieces, throttle bushings and mechanical seal faces are other parts hard-faced on the same production fixtures. Some of these hard-faced parts are shown after finishing on the table in the center of Fig. 5.

For such applications as these, the pump division plant consumes large volumes of oxygen and acetylene. These gases are supplied from cylinder manifolds on an outside storage platform (Fig. 6). Oxygen pipe lines are painted green, acetylene lines red to correspond with the cylinder colors.

Production hard-facing work is done by twelve certified welders under the supervision of Welding Foreman Mike Kerzner (standing behind table in Fig. 5), who has been with the company for 22 years.

Flexible Overhead Handling

The pump plant has an extraordinarily complete and flexible overhead handling system. Craneways for bridge cranes span the 60 by 400 ft heavy materials storage area, each of the 60-ft bays in the 130 by 375 ft machine shop building and also the 60 by 140 ft building that houses the operations of cleaning, grinding, welding, hard-facing and heat treating.

Every square foot of storage and operating area is thus served by the two 5-ton cab hoists, which can carry materials, parts in process or completed pumps from any designated point to any other location in the building. Welding and allied operations are incorporated as an integral part of the single overall overhead handling system flow.

DRILLING TOOLS

Immediately across Vernon Avenue from the pump plant are Byron Jackson's No. 1 plant, which manufactures oil well drilling tools, and No. 2 plant, which does work for both the drilling tool and pump divisions. The No. 2 plant has a crew of around 12 weldors, working under Foreman C. H. Barger, who are engaged in the hard-facing of rock bit cutters (Fig. 7) and soft formation bits. Also under Foreman Barger's supervision is the adjacent assembly department where drilling bits, power tongs and spinning tongs are assembled.

The cutters and bits are made of SAE 4320 (molybdenum steel), heat treated to a maximum hardness. The tungsten-carbide hard-facing applied to them is a product of the company's own metallurgical department. It is made up in 25-lb lots. First, a 99%-pure tungsten powder of 300 mesh fineness is mixed with the proper proportions of graphite (carbon) to complete the chemical compound. The two elements are thoroughly mixed in a mechanical mixer and the powder is placed in a graphite tray 18 in. long by 2 in. wide. The evenly distributed powder is heated from one end to the other with a carbon arc, which results in the formation of tungsten carbide.

This hard, brittle product is broken down into fine particles in a roller-type mechanical crusher. The particles are sorted through siz-

(Continued on page 34)

1—FRONT-MOUNTED MOWER, Dale's first product using extensive welding

2—SIDE-MOUNTED mower came next

Farmers Save Money Buying These

Welded Farm Implements

Strength without excess bulk, lack of investment in heavy presses, less floor space for fabrication—these are also big advantages of welded steel construction, says this farm equipment manufacturer

BY EMMETT DALE, JR.
Dale Implement Co., Franklin, Ohio

IT HAS been our experience with farm machinery that the greater part of it is not sufficiently stressed to withstand shock loads. If it does have the tensile strength to withstand shock, it is too heavy and bulky to be easily handled by one man, to say nothing of the increasing power requirements.

Less Weight with Welding

When we went into the manufacture of farm implements, we decided to try welding in place of casting and forging in an effort to overcome the above difficulties. Our first attempt at using extensive welding resulted in the front-mount mower (Fig. 1). We have since extended the use of welded steel construction to all of our products, which now include a terracer with a 6-ft reversible blade, a two-shank attachment to the terracer frame to break up hard spots or pull up rocks, a fertilizer attachment for plow and cultivator, a utility box of 12-gauge sheet steel for tractors and an attachment to convert any lift-type disc harrow to the towed type within a few seconds.

Taking the front-mounted mower as an example of the advantages of welded steel construction, one man can mount or dismount this machine in a matter of minutes because of its lighter weight. Yet it has an overload strength of approximately 150% under ordinary operating conditions.

Another example is the side-mounted mower (Fig. 2). This type is usually rather difficult to mount and expensive to manufacture. We overcame the mounting difficulty, however, by using a two-point attaching system, which is rather undesirable with casting or forgings because of the long suspension distances. This machine has given more actual strength than could ever be required of a mower. Being of welded steel, it is flexible enough to absorb a large part of the vibration inherent in this type of equipment.

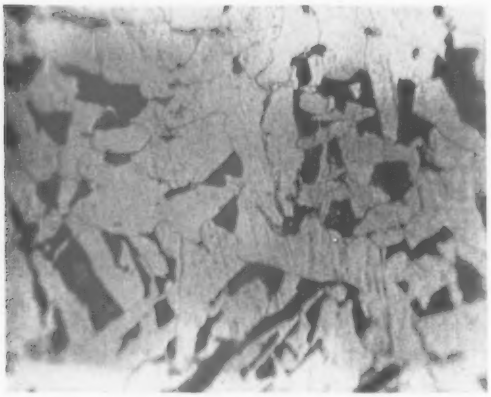
Another great advantage we gain by this type of fabrication is the lack of investment in heavy machinery such as punch presses, forming presses, bending brakes, furnaces, etc. The extensive employment of flame-cutting, both hand and machine, eliminates the expense of large forming dies. Nowhere has any part been encountered that could not be made by the combination of flame-cutting and welding. Even mower shoes and yokes are made this way.

Simple Procedures

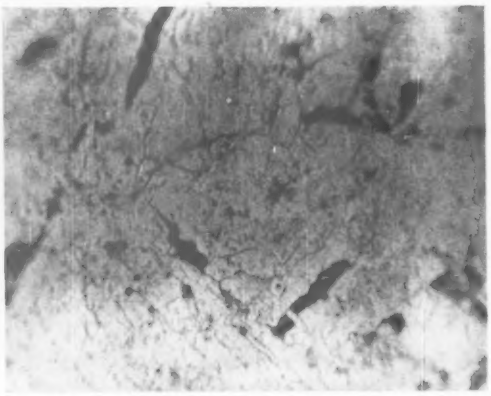
If a part is to be subject to a very great strain, it is veed out prior to welding, but this has not been necessary to a very great extent. In most cases, the cutting templates are so shaped as to bevel the parts while the outlines are being cut.

A moderately skilled operator is necessary on some of our cutting jobs, but most of them could almost be done by an amateur. As for our welding, it is done entirely with straight polarity d-c and all work in a downhand position. Most of the set-ups are made by the weldor himself in table top jigs. With the exception of the finished or nearly finished product, the assemblies are light enough to be handled easily by one man.

Welded construction has also brought us a big saving in the floor space required for fabrication. That means a great deal in these days of high building costs. The savings made by welding have allowed us to market our products at a saving to the consumer, which is certainly a big selling point in these days of tough competition.



1—BASE METAL



2—NEUTRAL FLAME

If you want to make a good

watch flame adjustment

Is the flame neutral? If it isn't, are you sure you are using the oxidizing or the carburizing flame under proper conditions?

BY A. DiNARDO
Welding Engineer
Coast Metals, Inc.

EXTENSIVE use of the oxyacetylene flame in welding has fostered a rather wide distribution of knowledge concerning the proper flame adjustments for the various weldable metals. Generally vague in the minds of most weldors, however, is any concept of the effects of *improper* flame adjustment upon weld metals.

The appearance of a weld seldom indicates whether or not its physical properties will measure up to requirements; failure of the joint is in most cases the only cause for an investigation in this direction. If failure occurs, a metallographic examination will in many cases reveal defects traceable to the use of an improper flame adjustment.

"Burned" Weld Metal

A failure will often cause conjecture as to the possibility of the weld metal being "burned," a term used to denote that the molten puddle was held over too long a time. Burning is simply oxidation. It can occur, even with a neutral flame, but its effects in single-pass welds are more accurately traced to the loss of elements resulting from exposure to an oxidizing atmosphere rather than to the time-temperature aspect. In the low-alloy, high-strength steels, it is associated not only with the formation of oxides but with the loss of carbon, chromium, molybdenum or other valuable elements. In the common structural steels, the element loss is largely confined to carbon. In either case, however, the strength and ductility of the weld is seriously impaired, often to the point of failure.

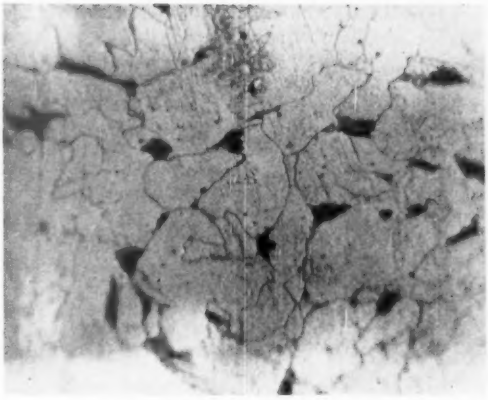
The aircraft industry has been acutely aware of these difficulties, probably more so than any other industry, since 95% of all aircraft welding was done by the oxyacetylene process prior to World War II. Because of the complex structures fabricated of high-tensile SAE X1430 steel, welding had to be accomplished under the most difficult conditions. Converging members of light-walled tubing and heavy forgings required the concentration of high amounts of heat in order to meet the minimum requirements on penetration. Such conditions aggravated the already difficult problem of controlling the quality of highly stressed welds in primary and secondary structures.

Many inexperienced weldors have deliberately resorted to the use of an oxidizing flame in an attempt to take advantage of the additional 200 F of heat. In some instances where the weldor's skill was under par, the slightly higher flame temperature would enable him to penetrate tight corners where heavy masses of metal were conducting heat away from the weld zone at a very rapid rate. Unfortunately for all concerned, the resulting welds appeared to be completely acceptable from a visual examination. Metallurgically, however, they were unrecognizable as the original alloy and were lacking in strength and ductility.

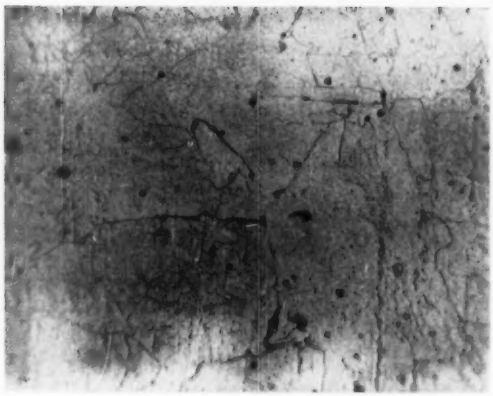
Test Three Flame Types

To demonstrate the importance of proper flame adjustment, various test specimens of several ferrous-base metals were made up. Welds were made with three different flame adjustments: neutral, oxidizing and carburizing. The flame adjustment showed profound effects upon weld-metal composition and physical properties.

The base metal was SAE 1025 steel, and the filler rod was of the following composition: 0.06% carbon, 0.25% manganese, 0.04% maximum sulphur and phosphorus. Test sections were etched in Nital. The accompanying photomicrographs at 400 magnifications illustrate the flame effects upon composition:



3—CARBURIZING FLAME



4—OXIDIZING FLAME

gas weld—

1—Base Metal in weld zone is typical of mild-carbon steels and shows normal amounts of ferrite and pearlite. Tensile strength is 55,000 psi; ductility, elongation of 22%. A specimen of this material took a 180-deg bend without fracture.

2—Neutral Flame. Weld deposit was made with a strictly neutral flame. The reduction of pearlite is due to dilution with weld metal from the lower-carbon filler rod. The structure is normal in every respect. A tensile specimen fractured outside the weld. The weld took a 180-deg bend without fracture.

3—Carburizing Flame. Weld deposit was made with a slightly carburizing flame. The increase in pearlite is the result of the addition of carbon from the excess acetylene in the flame. Because of the increased carbon, this weld could be expected to show a higher tensile strength than the weld in picture 2, but its ductility would undoubtedly be lower, Nevertheless, the bend test showed no fracture at 180 deg.

4—Oxidizing Flame. Weld deposit was made with a slightly oxidizing flame. The structure is coarsely ferritic, with no evidence of pearlite. Iron oxide is evenly distributed. Carbon removal has occurred through a reaction with the excess oxygen in the flame. This weld exhibited a tensile strength of only 32,000 psi and an elongation of but 10%. The weld metal developed fractures at a 90-deg bend.

When to Use an Oxidizing Flame

Although the excess oxygen and excess acetylene flames were detrimental in the foregoing instance, they may be beneficial for other types of welding operations. A slightly oxidizing flame, for example, will greatly improve the flowing characteristics and physical properties of the zinc-bearing bronzes—a fact known to all weldors. In this case, the formation of a thin film of oxide over the surface of the puddle serves to prevent the boiling out or vaporizing of the zinc. An oxidizing flame is also of benefit in the brazing of cast iron since the excess oxygen will burn off the free graphite on the surface of the scarfs. This graphite, usually smeared on by the grinding wheels in the preparation of the vee, will seriously impede the flow of the weld metal unless it is removed.

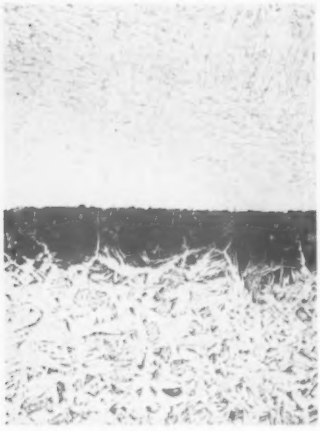
When to Use Carburizing Flame

The excess acetylene flame has the virtue of lower temperature, which renders it useful with the lower melting alloys such as silver-brazing alloys, soft solders and also in the fusion welding of zinc-base die castings. Its use is restricted, however, in certain cases. An outstanding example of what not to do is heat electrolytic copper in a carburizing atmosphere. The embrittlement which always results is believed to be traceable to the combination of hydrogen in the flame with oxygen in the metal, the union causing water vapor to be formed at the grain boundaries.

The carburizing flame shows both advantages and disadvantages in the welding of ferrous base materials, depending a great deal upon what the weldor is trying to accomplish. Prior to the advent of the stabilized austenitic stainless steels, one of our most troublesome problems was the intergranular corrosion resulting from precipitated carbides. Aircraft exhaust collectors, for example, were particularly susceptible to this condition. These were at one time fabricated of non-stabilized 18-8 and welded with the same type of filler metal.

Major consideration covering analysis of the welding rod at that time was the carbon content, which was held at a maximum of 0.06%. With this type of low-carbon rod, the amount of precipitated carbides in the fusion zone could be held reasonably low when welding was done under the proper conditions. As further assurance, however, the parts were usually subjected to a solution heat treatment after welding.

An investigation of actual failures involving welds, made under apparently ideal conditions and later heat treated, disclosed several instances in which the carbon content was above its normal limits. In each case, the trouble was traced to the use of an excess acetylene flame. It was corrected when the weldors were made to realize the importance of using a flame strictly neutral. The reason why the failures were so pronounced may be at least partially because of the very high temperatures the collectors reached in service. The effects of the solution heat



5—HARD-FACING DEPOSIT above was made with a three times carburizing flame. Black band at fusion zone is carburized base metal

treatment were destroyed by the elevated temperature.

In some processes, a carburizing flame is advocated for the fusion-welding of low and medium carbon steels. A slight excess of acetylene is beneficial in increasing the speed of welding since it lowers the melting point of the base metal on the surface of the scarfs. The addition of carbon forms a thin layer of high-carbon steel, usually ranging from 0.005 to 0.010 in. in thickness, with a melting point several hundred degrees lower than that of the unfused metal. It is possible to raise the carbon content to a point (4.3%) where the melting temperature of the thin layer is as low as 2,200 F.

Carburizing in Hard-Facing

This carburizing of the parent metal is the basis of the sweating condition used in the application of hard-facing alloys. The high-carbon steel layer permits the perfect fusion of these complex alloys to the base without the ill effects of dilution.

Normally, the strength of such a bond is more than adequate. If the hard-facing deposit is rapidly cooled, however, it may spall under heavy loads through failure of the highly carburized fusion zone. A rapid quench will, of course, convert the carburized area to martensite, reducing its impact resistance considerably. The tendency is aggravated by the fact that most hard-facing alloys have a relatively high coefficient of expansion and consequently tend to shrink more than the base metal. If the part is restrained so that distortion is prevented, the shrinkage is retained in the form of residual stresses. The additional stresses encountered in service may act upon incipient cracks and would quite likely result in spalling. Picture 5, a photomicrograph at 100 X, shows the extent to which carburization can take place.

The carburizing flame not only increases carbon on the surface of the base metal, it also has the same effect upon the hard-facing alloy. This helps to make up for the normal loss of carbon in the welding operation and may increase wear resistance over similar deposits made with a less carburizing flame. Normally, the true hard-facing alloys depend very heavily upon high amounts of carbon to convert the alloying elements to the carbides necessary for extreme resistance to wear. Any operation which has a tendency to reduce the carbon would also affect the wearing quality of the deposit.

From the standpoint of good welding practice, the flame adjustment is as important as the selection of filler rods or the weldability of the base metal. It takes all three to assure perfect welds.

PREHEAT TO 500 F

(Continued from page 30)

ing screens into several grades of mesh fineness varying from 20 to 100. The properly graded tungsten carbide is then packed into thin-walled seamless tubes 20 in. long. There are six diameters of tubing: 1/16, 1/8, 3/16, 1/4, 5/16 and 3/8 in. Naturally, the finest powders are placed in the smallest-diameter tubes, the coarser particles in the larger. Bits for hard formations are hard-faced with the coarser particles, using (mostly) a No. 49 drill-size torch tip (orifice of 0.073 in.). The soft formation bit requires a finer powder and is generally applied with a tip having an orifice of No. 50 drill size (0.1285 in.).

Five welding booths are needed to weld arms on hard formation bits and blades on soft formation bits. A new type of soft formation bit has detachable blades, both "three-way" (three cutting blades) and "fourway." Grooves are machined in the body to receive the blunt edges of the previously hard-faced blades. Beads are then are welded to the sides, front and back of each blade to hold it in place. When dulled to the point of inefficient drilling, the blades can be cut out with a torch and replaced by new hard-faced blades, which are welded in place in the same manner as the originals.

The roller cutters are much softer than the hard-facing, which is put only on the leading edges and ends of the protruding blades. As the tungsten carbide wears down, the softer base metal also wears away, maintaining a sharp cutting edge. Obviously, if the cutter blades were hard-faced on both sides they would wear down to bluntness and "walk" instead of cut during drilling.

The welding department of the No. 2 plant does other work than the hard-facing of cutter bits. Fig. 8 shows the fabrication of a portable trailer to bring compressed air into the oil fields. The trailer carries a compact combination of an air-cooled gasoline engine, air compressor and air tank. The compressed air is used to power the tongs employed in making up strings of casings, saving a lot of hand work and many man-hours of labor.

To supply the heavy consumption of acetylene in the No. 2 plant, two acetylene generators are used alternately. When the pressure falls in one generator, its mate is cut into the 2-in. supply pipe line leading to the welding department. The generators are housed in a separate building with a loose roof and 10-in. brick walls; besides the 8 by 10 ft generator room, the little brick building also contains a 6 by 10 ft chamber for carbide storage.

Oxygen is supplied through a central manifold divided into two sets of cylinders. When the pressure from one set falls below working pressure, the other set is cut into the line. A master regulator reduces the 2,000-psi cylinder pressure to the proper 40-psi working pressure.

1—WITHOUT INTERRUPTING service, a weldor of the Los Angeles Transit Co. built up old rails to the same height as new ones. Shield protects passersby from arc

2—HOW BEAD WAS LAID to produce a gradual slope from the old to the new rail. Four passes were made at each joint with 13-15% manganese-steel electrodes

Bumps Avoided

New streetcar rails turned out to be ¾ to 1 in. higher than adjoining older section. To avoid bumping passengers, emergency build-up was made by welding

BY IRA CARROLL

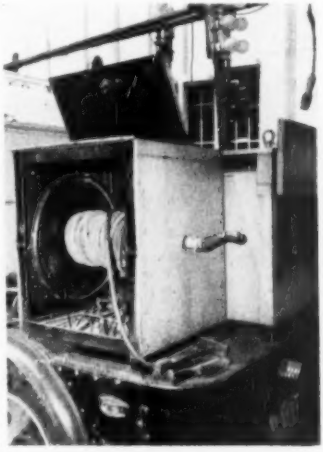
TROUBLE shooters for the Los Angeles Transit Co. never know what subsurface conditions will be encountered when streetcar rails are unearthed. Some ties and rails will hold up for 25 years while others need replacement in five years, depending on soil conditions and other variables. It simply isn't possible to say what the rails will look like when rail trouble is spotted from the street level.

One particular job at a busy street intersection looked easy but turned out to be—well, one of those things! The rails were pulled out for replacement while traffic was moving as usual. Because one section of rails supported heavy street traffic, it was left temporarily in position while the old rails on either side of it were replaced with new ones. Then the trouble started. The old rails were ¾ to 1 in. lower in height than the adjoining new ones and simply would not join up with them so that streetcars could run without big bumps to passengers.

A company weldor was called upon to meet the emergency. He quickly solved the problem by building up the old rails with 13-15% manganese-steel electrodes. Fig. 1 shows the operation, which was done in the daytime and without interference to streetcar service. Note the shield employed to safeguard the eyes of passersby from the welding arc.

Four beads were laid on each rail to gain the required height (Fig. 2). Current used was 140 amp at 40-60 volts. The work was so timed that streetcar service continued as usual. The built-up rails were, of course, only a temporary expedient. Late that evening when street traffic had subsided, a night crew pulled out the old rails and replaced them, as had been originally planned.

The welding truck of the Los Angeles Transit Company can boast of a rather neat homemade cable rack (Fig. 3). An old transformer handle is used to crank in the welding cable. The hinged lid, shown in the picture as resting on the top of the box, folds down and fastens when not in use. At the rear of the cable reel is a welded cabinet containing a rack of knife switches. The weldor can control the voltage by simply engaging the proper combination of switches. Each switch is plainly marked with the amount of voltage it furnishes.



3—CABLE RACK uses old transformer handle to crank in welding cable. Cabinet at rear holds knife switches to adjust welding voltage.

Building cabinet drawers . . .

1—DRAWER BEGINS to take shape when front channel and face are secured with two quick-acting clamps

2—RUNNERS are spot welded on machine at left, after which assembly is placed on the roller conveyor

Fixtures Aid Welding

BY WALTER RUDOLPH

Here are some neat ideas on fixturing which you may be able to put to work in your own plant. Note particularly the three different types of fixtures in the three pictures below, designed to speed production with welding guns

How Drawers Are Made

FABRICATION of "American Kitchens" cabinet drawers at American Central Division, Avco Mfg. Corp., Connersville, Ind., proceeds at the rate of about 116 units per hour through a studied grouping of machines, conveyors and successive operations. Resistance welding, precision fixtures and good handling are combined into the picture.

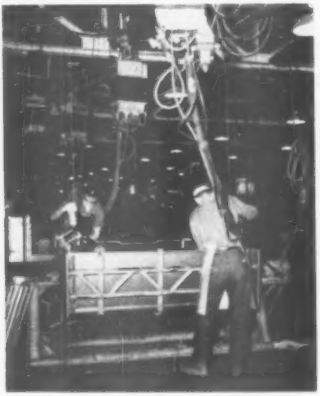
A drawer measuring about 15 in. on the front begins to take shape when the front channel and face are secured with two quick-acting clamps (Fig. 1) and the body with three such clamps in a small fixture constructed of 1-in. angles and small sections of steel plate. This clamping is done on a work table near the first spot welder; after the operator has clamped the subassembly, he takes it to the machine and welds three spots on each side of the drawer. He then removes the fixture and passes the drawer frame along.

A second operator at an adjacent table places the welded subassembly

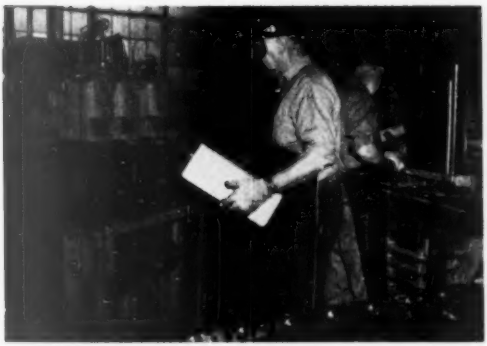
Spot welding cabinets . . .

5—PEDESTAL fixture for assembling sides and bottom of cabinet. Braced upright rides on castors

6—PARALLEL FIXTURES travel on rails while channels are added to the bottom-and-sides assembly



7—TRUNNION fixture serves for final assembly. The components are held in place by air pressure



3—SHEET-STEEL front is added in fixture at right. Multiple spot welder at left puts in the partitions

4—GAS WELDING to clean up the corners is the final operation before delivery to enameling department

of "American Kitchens" Cabinets

in a special fixture for the location of drawer runners. This fixture is made of bar steel and has spring clamps as well as a quick-acting clamp. When the runners are in place, the operator turns to his machine and spot tacks the assembly to hold it at this stage.

The drawer is now passed to a third operator, who inspects the foregoing work and then completes the spot welding all over the subassembly. He then turns around (Fig. 2) and places the drawer on a roller conveyor about hip-high, to be carried to other workers down the line.

Removed from the conveyor, the drawer is up-ended in a wooden holding device (right of Fig. 3) to aid in assembling the 22-gauge steel front piece. This front has deadener applied on its concealed side, a feature of American Kitchens drawers. A hammer clenches the corners.

Some drawers are given dividers (partitions) in a specially constructed multiple spot welder (left of Fig. 3). The operator merely inserts the drawer in the machine, positions the divider and presses a button to have six spots welded simultaneously.

Final operation on these drawers is gas welding (Fig. 4) to fill the gaps of the previously clenched corners. The operator removes the drawer from the roller conveyor, up-ends it in a fixture where it is held with quick-acting clamps and welds the corners with a mild-steel filler rod. The above procedure holds for the fabrication of all drawers up to 30-in. width. After the corners have been cleaned up, the drawers pass along the roller conveyor to a hang-on station, from which they are carried by the conveyor leading to cleaning and enameling operations.

Cabinet Assembly

FIXTURIZING and grouping of operations is important in the assembly of kitchen cabinets, too. The work often proceeds in two lines, headed by a special rotating double fixture welded up of I-beams and plate steel (Fig. 5). The bottom of this device swings in a circle on a center pin anchored to the floor.

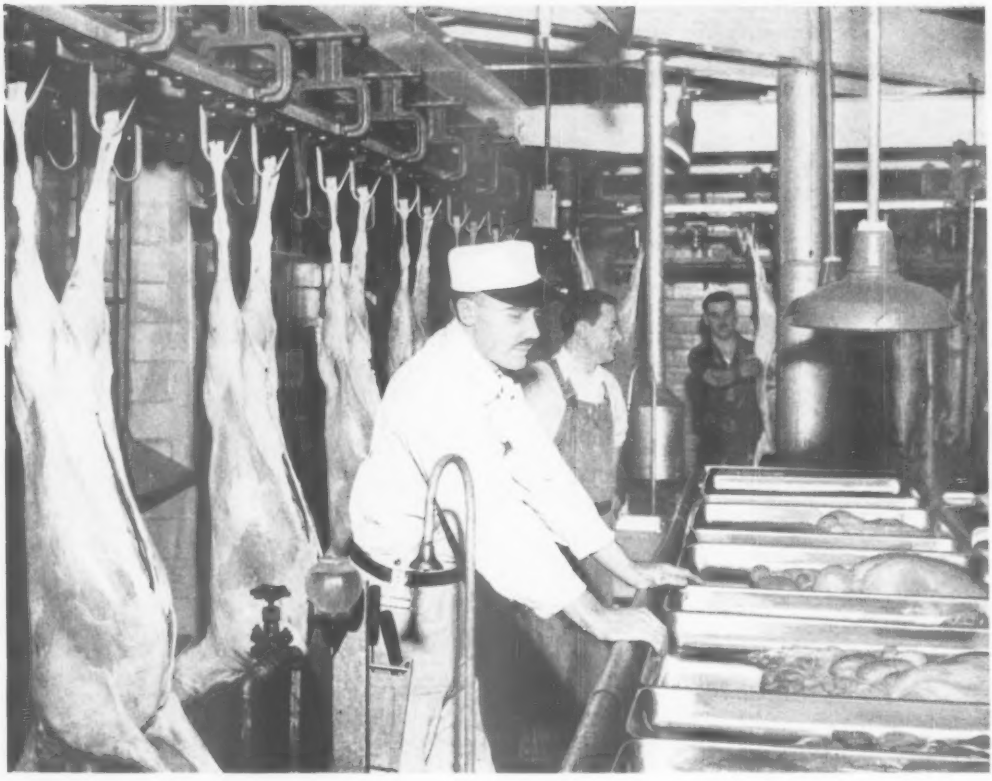
At each end of the base, which is about five feet in length, a braced upright rides on two castors. This serves as a pedestal to hold the framing work table at a convenient working level. The table can also be rotated for easier handling and welding.

Several men work to bring the bottom and sides of a cabinet together in the table-top fixture and clamp them with quick-acting clamps. The embryo cabinet is spot welded with a welding gun, hanging conveniently overhead and counterbalanced to take the load of the gun off the weldor's arms. This particular welding gun has an exceptionally deep throat for welding far into the cabinet frame and around fixture parts.

Leaving the first welding operation, the skeleton cabinet passes on a floor-level roller conveyor to more gun-welding operations on either of two parallel fixtures (Fig. 6). Each of these fixtures, made for framing and squaring of cabinets, rests on four wheels that move it along sideways on channel rails. Four overhead welding guns also travel sideways on a trolley, giving weldors great freedom of movement.

Quick-acting clamps are used as well as a knee-action clamp to give greater pressure on one side of the cabinet. The purpose of each of these traveling fixtures is to add channels to the bottom-and-sides assembly from the first framing fixture. The first operation is merely tacking but in the second all corners and channel welding are completed. Special alligator-type and wheel-type welding guns (Fig. 6) speed fabrication.

Another interesting fixture at American Central (Fig. 7) is used for final assembly. This fixture was fabricated of 2-in. welded pipe, bar stock and heavy plate steel. It has a welded base of 4-in. pipe and turns on trunnions. One end of the fixture is forced into place after loading by air-pressure, firmly holding the entire assembly — drawer slides, side panels, inner panels, hinge support and top channels — into alignment for gun welding.



1—SHEEP VISCERA move with the opened carcasses in stainless-steel pans on conveyor-type inspection table. If an inspector finds evidence of disease on particular viscera, there is no doubt as to the carcass to which they belong

Welded Machines

Higher standards of sanitation are provided by welded meat-packing equipment made by Allbright-Nell, Chicago. Spot and stud welding give faster production, do away with drilling and fitting problems

BY WILLIAM C. HENZLIK

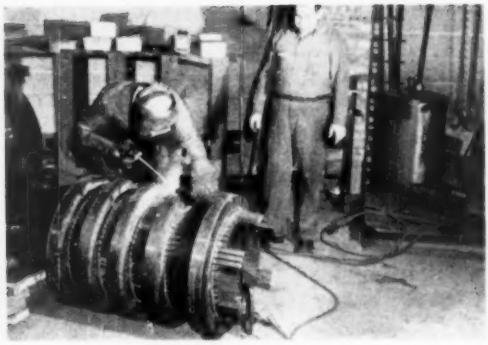
WELDING and welded products are helping the American meat-packing industry to achieve its goal of higher standards of cleanliness, lower-cost production and utilization of by-products. Welding is indispensable to the fabrication of meat-processing machinery manufactured by the Allbright-Nell Co., 5323 South Western Blvd., Chicago. One of the oldest and best established firms in its line, Allbright-Nell is housed in a single two-story building 390 by 140 ft. The concern has 289 employees. In the words of its superintendent, it is a big "job shop," which means that the bulk of its products are built to fit the building sizes of individual meat packers. It has its own stores, assembly, casting, machining and fabricating departments.

Arc to Spot Welding

Major fabricating tool in the plant is the arc welder. There are 11 a-c welders of 300-amp capacity, six 200-amp d-c machines and one each d-c welder of 400 and 300 amp. Most of these are in constant operation. Twelve welding booths handle the fabrication of stainless sheets, aluminum castings and mild steel. Some seven other welding stations across the assembly floor are reserved for the welding of machine bases, conveyor tables and miscellaneous heavy work. A 50-amp d-c welder of the electronic rectifier type is employed occasionally on thin-gauge metal.

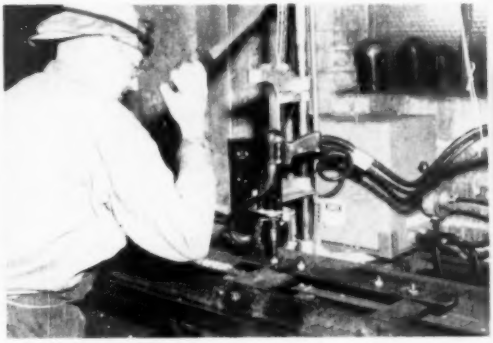
The plant's varied welding equipment also includes an atomic-hydrogen welder, a press-type spot welder and a stud welder. Oxyacetylene welding and cutting torches are used extensively for cutting, flame-bend-

2—BRACKETS are spot welded to viscera pan bottoms to attach pans to the endless chain that carries them



3—SIEVE OR CURB for crackling press holds back the solids when lard is squeezed out under pressure

4—SHACKLES TO LEAD sheep to the slaughter are made by gas welding the separate chain links together



5—PERFORATED locating fixture insures quick attachment of studs to the "flights" of endless chains

to Process Meats

ing, brazing and in the maintenance of plant machinery. A flame-cutting machine fitted with a magnetic tracer turns out the mild-steel shapes that lend themselves to duplicate production.

Products Manufactured

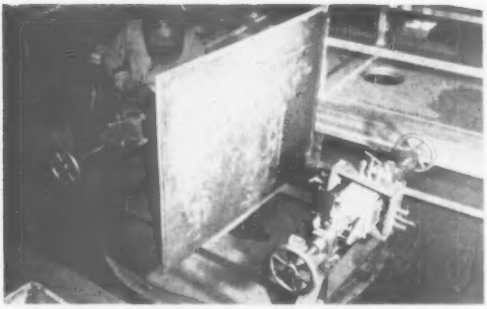
Some 714 items of meat-processing machinery, exclusive of replacement and maintenance parts, are listed in the firm's catalog. Some of the smaller machines may measure less than 5 by 18 in. square. Others, "hog scrapers" for instance, may be 20 ft high, 12 ft wide, 30 ft long and weigh 33 tons.

An interesting product, about the size and shape of a bathtub, is the manually operated four-wheel truck for transporting sausage materials. Formerly, these trucks were made of galvanized sheets, formed and riveted together. The galvanizing process was necessary to protect the metal against corrosion. But there was always the danger that a sudden collision might dent the zinc coating, undermining the galvanizing and forming a breeding ground for bacteria. The hazard is now eliminated by trucks made of welded stainless shapes designed especially for sanitation. Initial cost of such a truck is considerably more than for the galvanized product, but the freedom from bacteria, corrosion resistance and greater strength and durability of stainless serve to offset the cost.

Bacon slicers are one of the best known products of the Allbright-Nell Co. and demonstrate several features of welded design. Slicer base, slicer leg and conveyor table are all-welded. A part of the slicing mechanism itself is also welded. The knife guard is of cast aluminum. The conveyors can be set up to any desired length that is a combination of 10 and 4 ft. All units are standardized and tooled for interchangeability.

Stainless Viscera Tables

Because of its corrosion-resistant and sanitary properties, stainless steel is finding wide usage in the meat-packing industry. An excellent example are the stainless steel pans for



6—ATOMIC-HYDROGEN welding helps fabricate the stainless-steel boxes in which canned hams are formed

7—FLAME-STRAIGHTENING is done on cooker shaft to remove a slight warp. Paddles will later be added

moving-top "viscera tables" (Fig. 1). The table itself offers a fine example of the industry's search for high inspection and sanitation standards. As each carcass comes to the head of the table, its abdominal cavity is split open and the contents removed and placed in a pan.

Above and beside the table is a moving chain from which are suspended hooks for supporting the opened carcasses. Each carcass moves alongside and adjacent to the pan containing its viscera. If an inspector should find evidence of disease on particular viscera, there can be no doubt as to which carcass they belong.

Each viscera pan is formed from a single sheet of 14-gauge stainless. The sheet is cut to size, and its corners are blanked with a die. Sides are bent with the bending brake. Finally, the corner seams are welded with AWS-ASTM E-308-16 electrodes.

Fig. 2 shows the brackets on the bottom of the pan for attachment to the endless chain in the table top. These brackets are now spot welded. Formerly, they were bolted to the pan bottom, which necessitated countersinking and sealing operations so that small seams and cracks around the bolt holes would not remain as breeding places for bacteria. Spot welding takes less time, does away with drilling and fitting problems.

A 2,400-Lb "Sieve"

Forged annular rings and cold-rolled steel bar stock are welded to form a 2,400-lb "sieve" (Fig. 3). This bulky strainer retains the solids when lard is squeezed from cooked meat scraps under pressure. A force of 400 to 600 tons is exerted by the piston moving inside the big basket to compress the cooked scraps. The bars are of keystone cross-section and are made of SAE 1020 steel.

A circular jig with slots to hold the bars upright is used for assembly. The first ring is tack welded to the bars, after which another ring is slipped over the opposite end and also tack welded in place. The basket is then taken from the jig and rolled on its side (as shown in Fig. 3) for finish welding. A single pass is made on each contact surface with 1/4-in. E-6012 mild-steel electrodes.

Gas-Welded Chain Links

Since so many of the machines which handle animals for processing in a packing plant require chains, it is often necessary to fabricate special combinations of swivels, rings and links. The oxyacetylene torch is used extensively for this purpose. Fig. 4 shows the manufacture of a chain for a sheep-hoist. Both hog-hoists and sheep-hoists are essentially sturdy frames to support moving chains for carrying hogs or sheep from one level to another for killing and cleaning. Welding not only offers versatility in chain types but does away with stretched links, cracks in links and hard-to-clean attachments.

Stud-Welded Brackets

Stud welding has proved to be fast, economical and efficient in the production of "flights" (Fig. 5). These are platelike brackets which are fastened to the endless chains of dressing and cutting tables and similar machinery. Former practice was to drill the flight and fit in four galvanized carriage bolts by hand. Present method is to use a locating fixture made from a perforated piece of sheet steel. Two edges are bent down to center the fixture when it is placed over the plate. The stud-welding gun is then brought down to the first hole in the fixture, and the welding cycle begins. After all of the studs have been welded, the piece is hot-dip galvanized at an outside shop. Threads are cut into the studs after galvanizing. For some companies, stainless bolts are stud welded to stainless plates.

Stainless-steel boxes for forming canned hams are welded by the atomic-hydrogen process (Fig. 6). A rotating positioner with two holding fixtures is operated by two men; one puts in the blanked pieces and fits them up while the other welds. Three components are fastened together in the holding fixture before it is swung around under the manual atomic-hydrogen arc torch.

Flame-Bending

Flame heat is utilized to straighten such parts as the cooker shaft in Fig. 7. The weldor is heating the top of the hexagonal shaft to straighten a slight warp. This shaft will later have large mixing paddles fitted to it to agitate meat scraps while they are cooked inside a double-jacketed steel cylinder about 5 ft in diameter and 15 ft long. Steam circulates through the jacket for cooking.

A screw press is used to take small irregularities out of flat plates that have been drilled, punched, sheared, etc. The section is heated with the torch after pressure has been put on the distorted section by means of the screw blocks.

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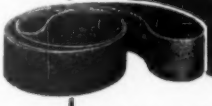

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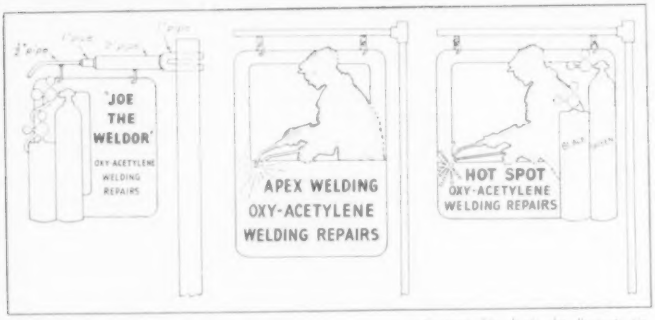


IF YOU DO CUTTING, cut out a steel sign to hang over your door. It may bring in new business

Signs You Can Make Yourself

ADVERTISING is letting people know you are in business and telling them what you are prepared to do for them. Of course, when you do a good repair job and the customer is satisfied, he will probably tell his friends. That's the best advertising of all, but it takes a long time to build up a profitable business if that's your only advertising.

A sign on your building will help to bring in the customers quicker. An appropriate sign for a welding shop is one which you can make yourself with your own equipment and which also shows the kind of work you can do. The sketches picture several simple but attractive signs made from steel for shop fronts. Cut them out and weld them, then give them a bright coat of paint. Another way to make the letters is by bronze-surfacing. Clean them with a wire brush occasionally, and you'll have bright, attractive lettering.

A sign made by welding and cutting processes is particularly appropriate to a welding shop.

* * *

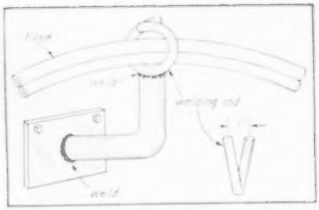
Gage for Hard-Facing Pins

DREDGE sheave pins are subject to abrasive action of sand, last but four to five days. Then the pins must be removed, hard-faced and turned down for re-use. To speed operations on a dredge operated at Santa Monica, Calif., N. J. Nilson, chief engineer, Standard Dredging Co., devised a simple labor-saving gage for hard-facing sheave pins.

Several angles were welded together to form a simple fixture and gage (see sketch). Tolerances for surface of a pin are close to eliminate sand from working in. Previously, build-up of the surface was a hit-or-miss job. Uneven hard-facing meant extra hours on the grinder. The gage now tells the weldor exactly how much hard-surfacing needs to be applied.

HARD-FACING dredge sheave pin. Pipe protects pin's threads from spatter. The sketch below shows simple construction of fixture

Splattering would oftentimes clog the threads and add to machining time. Nilson cut 4-in. pipe to fit over the threads and protect them during welding. This eliminated thread clean-up entirely. Previously, hard-facing, grinding down to a true surface and thread cleaning required 10 hours. Nilson's simple thread protector and hard-facing gage combination has cut the time in half.



HANDY SUPPORT you can make yourself. It can be mounted to either wall or work table

Protect Your Hose Lines

LEAKY HOSE lines can cause injury to you and damage to your shop. When you store hose, use a reel or lay it coiled on a shelf. Never hang hose on a nail because it will kink under its own weight. Carry it to a new location, never drag it. Avoid kinking and chafing.

If hose crosses the path of a vehicle, protect it with planks laid on both sides. Do not leave it where you may trip over it, or trample it. Don't pull it sharply. A sudden pull may break a connection or upset a cylinder.

It is often desirable to suspend hose from above to protect it from damage. A hose support can be made easily from welding rod and a length of pipe. The sketch shows one type of hose support you can make. The open ring permits hose to be removed easily, yet it can't slip out. Mount the hose support on your welding table or on the wall to keep hose out of the way and protected from damage. Hose supports like this save money because the hose is kept off the floor and won't kink or crack easily. Life of the hose is prolonged accordingly.

It is scarcely necessary to say that hose should be kept free of oil and grease as these substances not only deteriorate the rubber but constitute a fire and explosion hazard with oxygen. Any oil or grease that does get on a hose should be washed off with water, a little pine oil or resin soap and a good cleaning powder. Never use gasoline, kerosene or caustic soda because these materials will destroy the hose.

* * *

Strengths of Rope and Cable

By W. F. Schaphorst, M. E.

MOST users of rope and steel cable don't seem to know the relationship between the size of the rope and its strength. They know that a large rope is stronger than a small rope, and that's about all. It is therefore believed that the following rules will be welcomed:

To find the safe strength of a cotton or hemp rope, square the diameter of the rope in inches and multiply the product by 200 lb. Thus for a ½-in rope we have ½ x ½ x 200 = 50 lb, which is the safe strength.

For steel cable, square the diameter of the cable in inches and multiply by 12,000 lb. Thus for a ½-in. cable we have ½ x ½ x 12,000 = 3,000 lb, the required safe strength. Do not apply the latter rule to iron rope. Iron rope is not as strong as steel rope.

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Have superior physical qualities — ideal for welding heavy sections that must withstand severe shock and abuse.

Withstand high amperages and have high deposition rate. Operators burn more rod per hour, weld faster at lower costs.

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- ***For welding nickel-alloy steels;*** gives high impact resistance at low temperatures... *75LP.*
- ***For chrome-moly steels*** (1% Cr., ½% Mo.) used in power piping ... *80LE.*
- ***For chrome-moly steels*** (2% Cr., 1% Mo.) used in power piping ... *90LE.*
- ***To match heat-treating properties of SAE 1040*** and like steels. Also for steel-castings repair... *P&H40C.*
- ***For welding high hardenable steels.*** Also steel castings repair... *AW2B.*
- ***For repair welding Grade C castings*** and steels of similar composition... *P&H#7.*
- ***Comparable to SAE 8630 steel***...excellent heat-treating and flame-hardening characteristics... *90LH#2.*
- ***For welding high hardenable steels*** without preheat such as re-rolled rail stock... *P&H#12.*
- ***For aircraft and similar steels . . .*** has wide range of properties under heat treatments... *P&H#21.*

These rods operate with stable arc on AC or reverse-polarity DC. Other money-saving features are: Elimination of underbead cracking. Low hydrogen content for successful enameling. Little or no preheating. Minimum spatter. Excellent appearance of weld... freedom from surface holes. Order from your P&H representative or local P&H distributor. Send coupon for detailed information.

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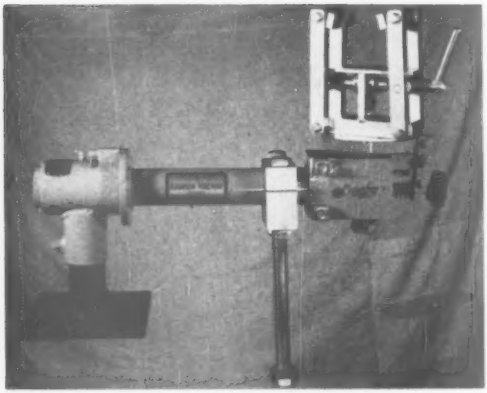
New products



BRAKES on work-table rotation and work-arm rotation provide extra control on positioner. Pin locks secure table and arm in position

HOME WELDER plus rectifier recharges auto battery in ten hours or overnight. Welder handles ¼ in. steel, brazing, soldering, etc.

Counterweight Balances Welding Positioner

IMPROVEMENTS in the Model 14B200 Aronson welding positioner permit 360-deg movement of the workpiece about the axes of the work-table, work-arm and pedestal axis. Brake bands on the table and the arm axes permit added control. Pin locks on table and arm firmly lock their positions.

A counterweight attachment on the positioner aids in operation. Tapered roller bearings on the work table rotation afford free turning for light loads and plenty of bearing support for heavy loads. Maximum capacity of the Model 14B200 is 200 lb.

ARONSON MACHINE Co., Arcade, N. Y.

* * *

FLIP-FRONT lens holder allows inspection of work without contaminating air in air-supplied helmet. Lens is extra wide

Air-Supplied Welding Helmet Protects Against Fumes, Rays

NEW welding helmet developed by Mine Safety Appliances and the safety department of the Ethyl Corporation protects the weldor against ultraviolet and infrared radiation, impact and pitting and inhalation of toxic fumes. Facepiece consists of an airtight rubber mask and chrome leather hood with flexible breathing tube connections.

Specially featured is the aluminum frame and flip-front assembly for holding the lenses. The flip front enables close observation of the work without interference of respiratory protection.

Wide angles of visibility are offered by the new facepiece—81 degrees lateral angle vision as against 60 degrees with standard shields. The incoming air stream enters the mask at chin level and flows over the lens window to prevent fogging. Outlets at jaw level direct the air stream around the hood's interior.

Applications for the mask are expected in the repair of leaded-gasoline tanks, carbon monoxide exhaust lines, refrigeration systems and pressure vessel maintenance. Only preparation of tank before welding is to eliminate the explosion hazard; previously, sludge, rust, scale had to be removed as well as liquid.

MINE SAFETY APPLIANCES Co., Braddock, Thomas and Meade Sts., Pittsburgh 8.

* * *

Low Hydrogen Electrode Line Produced by Harnischfeger

NEW line of low hydrogen electrodes produced by Harnischfeger consists of 14 types for all low hydrogen applications. All have been tested in the field and in the company labs.

Said to produce excellent welds on problem steels, alloy steels, and steel castings, the electrodes have a moderate penetrating arc and easy-to-remove slag.

HARNISCHFEGER CORP., WELDING DIVISION, 4400 West National Ave., Milwaukee 14.

Small Welder Plus Rectifier Makes Home Battery Charger

WITH the addition of a small rectifier (on front of welder above) the "Lincwelder 60" can be used for charging 6-volt lead-acid automobile batteries. This small 110-volt welder operates off the standard house light circuit fused for 30 amp. To charge a battery, the welder-rectifier is plugged into a light socket and the two leads clipped to the battery terminals.

In addition to charging batteries, the versatile little welder can join steel up to ¼ in. thick and do cutting, brazing, etc.

THE LINCOLN ELECTRIC Co., Cleveland 1.

* * *

PLASTIC cover lens for welding helmets affords many hours of spatter-free vision

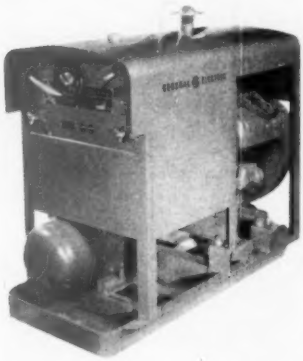
Plastic Cover Protects Welding Lens

NEW plastic cover lens for use over colored welding lenses on welding helmets is said to provide hundreds of hours of clear vision. Weld spatter will not stick to this plastic, the maker claims, until long after ordinary lenses are pitted and scarred. The plastic is optically clear.

OXO WELDING EQUIPMENT Co., 1235 West 95th St., Chicago 43.

for welding

Bench-welding positioner, air-supplied welding helmet and welder battery charger lead March New Products. Engine-driven welders, electronic torches and quick-setting C-clamps are also announced



OUTPUT RANGING from 200 to 500 amp, choice of air or liquid-cooled gasoline or diesel drives are offered in new welders

New G-E Welder Line Offers Models from 200 to 500 Amp

NEW General Electric WD-40 series of lightweight mobile d-c welders utilizes both gasoline and Diesel engines to drive the generator. The general-purpose heavy-duty WD-42AGW welder is driven by a 31-hp air-cooled engine with magneto ignition. Rated output of this model is 200 amp at 40 volts. Weight is 1,050 lb. A manually operated slow-down control economizes on fuel by slowing the engine to idling speed when welding is not in progress. Recommended for rugged duty operations such as pipeline work, the WD-42AGW is also available with a four-cylinder liquid-cooled engine.

Other new welders in the liquid-cooled gasoline-engine drives are the WD-43AG and WD-44AG, powered by six-cylinder 63-hp industrial engines. The WD-43AG is rated at 300 amp at 40 volts and weighs 1,725 lb. It is used for general maintenance and in construction work for welding beams and girders.

The WD-44AG has welding range of 80-500 amp and weighs 1,775 lb. Both models are equipped with belt-driven governors to prevent overspeeding of the engine as well as the automatic slow-down device.

The new series includes four welders with Diesel drives. Two 300-amp models, the WD-43ADGM and the WD-43ADC weigh 2,350 lb and 3,350 lb, respectively and have a welding range of 60-375 amp. In the 400-amp line, the WD-44ADGM and WD-44ADC have a welding range of 80-500 amp. All Diesel engines are equipped with batteries, generators, electric starters and preheaters for cold weather.

GENERAL ELECTRIC CO., Schenectady 5, N. Y.

• • •

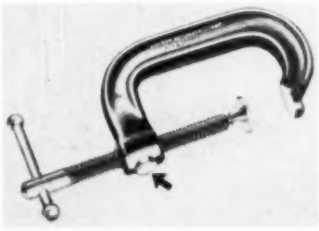
Ductile Welds in Cast Iron Claimed for New Electrode

NEW electrode for making machinable welds in cast iron is offered in a 15-in. length instead of the customary 14-in. The extra length decreases stub losses, says the manufacturer. The new "All-State No. 8 New Machinable Cast Iron Electrode" is recommended for a-c or d-c sources on straight or reverse polarity. Amperages used can vary from 4 to 180.

Welds made are ductile and have a tensile strength of 30,000 to 50,000 psi, states manufacturer. Other advantages are freedom from spatter, a smooth deposit, easy removal of flux residue.

ALL-STATE WELDING ALLOYS CO., INC., 273 Ferris Ave., White Plains, N. Y.

SUPER HOT electronic torch melts tungsten or firebrick with a flame exceeding 3,370 C (6,098 F). Developed by Dr. J. D. Cobine (above) of the General Electric research laboratory, the flame consists of nitrogen being passed through an ultra-high frequency arc. A quartz rod is being melted above. Operation of the torch involves breaking up nitrogen molecules into two individual atoms by billion-cycle-per-second frequency radio waves. Intense heat is released when the nitrogen molecules reform from the two atoms. No uses have been found for the torch, which is still in a laboratory stage of development. General Electric Co., Schenectady 5, N. Y.



CLUTCH on new C-clamp permits rapid closing on workpiece. Sizes are 4, 6 and 8 in.

Clutch on C-Clamp Allows Quick Setting

PRESSING of the "clutch" button (see arrow above) on a new C-clamp allows the clamp to be closed on the workpiece immediately. When the button is released, the clamp is tightened in the usual way. However, the clutch cannot be disengaged until the pressure has been removed.

These new Gordon automatic C-clamps come in 4, 6 and 8 in. sizes. Weldors and other workers are expected to find them useful for holding complicated structures at a number of points.

LOCKEY-FATER CORP., 401 Broadway, New York City 13.

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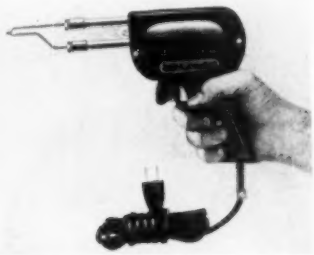

RAPID heating to working temperature claimed for Weller electric soldering gun

Solder Heated In Five Seconds

A NEW soldering gun is claimed by its manufacturer to reach working temperature in five seconds, and it also contains a small spotlight for illuminating the work. Gun is of the built-in transformer type, comes in four models ranging from 100 to 250 watts for general light-duty service or heavy-duty operations.

Housing of the gun is made of a combination of phenolic molding powder and a nitrile-type rubber. It is claimed to offer good thermal check resistance, great impact strength and good electrical characteristics.

WELLER MFG. CO., Easton, Pa.

TINNING PAINT is applied to cold metal with brush. Metal is tinned after heating

Tinning Paint May Be Brushed on Auto Bodies

NEW tinning paint for auto body repair is applied to cold metal with a brush. The surface is then heated with a torch until the paint bubbles and turns brown; all that is necessary after that is to wipe the surface with a rag. This new tinning process is claimed to be ten times as efficient as the older method of preheating and applying acid-core solder to the work surface.

Welds may be tinned while the deposit is still hot. The solution is simply painted on and then brushed over with a wire brush. Body solder may now be applied on top of the weld.

Other applications for "Ten-to-One" tinning paint are electric motor repairs, cream separators, cable ends, sheet metal fabrications, maintenance of urns, bars, etc.

SWISS LABORATORY, 3274 Stockholm, Cleveland, O.

* * *

FOOT-OPERATED rheostat reduces current at end of weld to eliminate weld craters

Foot-Operated Rheostat Eliminates Weld Craters

CRATERS at the end of a weld can be eliminated by connecting an "Arctrol" foot-operated rheostat, claims manufacturer of this product. As the welder approaches the finish of the weld, he depresses a pedal, which action reduces the current gradually until it reaches the vanishing point. The arc then snuffs out.

Inert-arc welding is said to be facilitated with the new control because the operator is able to weld at maximum speed. An extra cord and an auxiliary switch are provided to use with inert-gas panels.

Case and pedal are of heavy cast aluminum; pedal bearings are oilless. The resistance unit is the embedded type and has long wearing contact surfaces. A 15-ft. cord and plug are furnished.

MUELLENBACH ELECTRICAL MFG. CO., 2300 East 27th St., Los Angeles 11.

* * *

WELDOR cleans eyeglasses with tissue from wall dispenser needing one refill a month

Tissue Dispenser Aids Cleaning of Eye Glasses

METAL wall dispenser holds a month's supply of 3 by 7-in. "Sight Saver" glasses cleaning tissues. Safety engineers claim that productivity is increased because less time is required to keep glasses clean and employees can work faster and more accurately with clean glasses. Only servicing the dispenser requires is the insertion of a refill pack of tissues.

DOW CORNING CORP., Midland, Mich.

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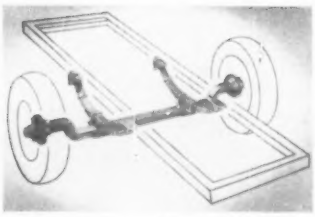

LOWERED center of gravity on welder trailers is achieved with new drop axle

Drop Axles for Trailers Of Portable Welders

RECOMMENDED for trailers carrying either portable engine-driven welders or transformer-type welders are new drop axles which lower the center of gravity of the load. By minimizing top-heavy characteristics, the new axle is said to provide increased protection against overturning of the trailer.

The drop axle assemblies include standard springs and wheel hubs similar to those used with straight axles. The drop part is specially forged to withstand road stresses. Standard drop is 4-in., but other drops are available to meet individual needs.

THE UNITED MFG. CO., 62 West Interstate St., Bedford, O.

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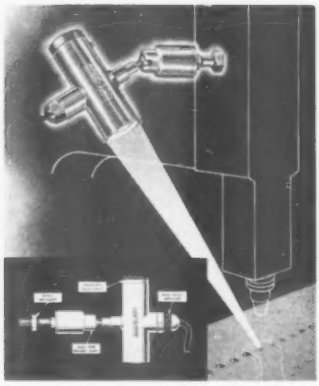


TO AID in locating workpieces, spotlight may be mounted on welders, riveters, etc.

Spot Welder Spotlight Helps Locate Work

A SMALL spotlight suitable for mounting on spot welders will aid seeing and help to position work in many delicate operations. A ball-and-socket joint allows free movement of the light. A special lens arrangement allows the size of the spot to be adjusted to as small as ⅝ in. in diameter.

Sturdily made, the spotlight is all chrome plated. It can be equipped with a transformer of 110 or 220 volt rating.

SCIAKY BROS., INC., 9915 West 67th St., Chicago.

* * *

Impulse Timer

FEWER parts, and no clutch or gears to wear out, are features of a new impulse timer, Model RT, made by Zenith Electric Co. It is designed for continuous repeat of impulse signal or to operate current on and off in equal periods of time. The mechanism is said to permit an adjustment of time periods from 3% minimum to 98% maximum of total time cycle of dial. Adjustment is made by moving a tripping rider on outer rim of dial to required time.

ZENITH ELECTRIC CO., 152 West Walton St., Chicago 10.

* * *

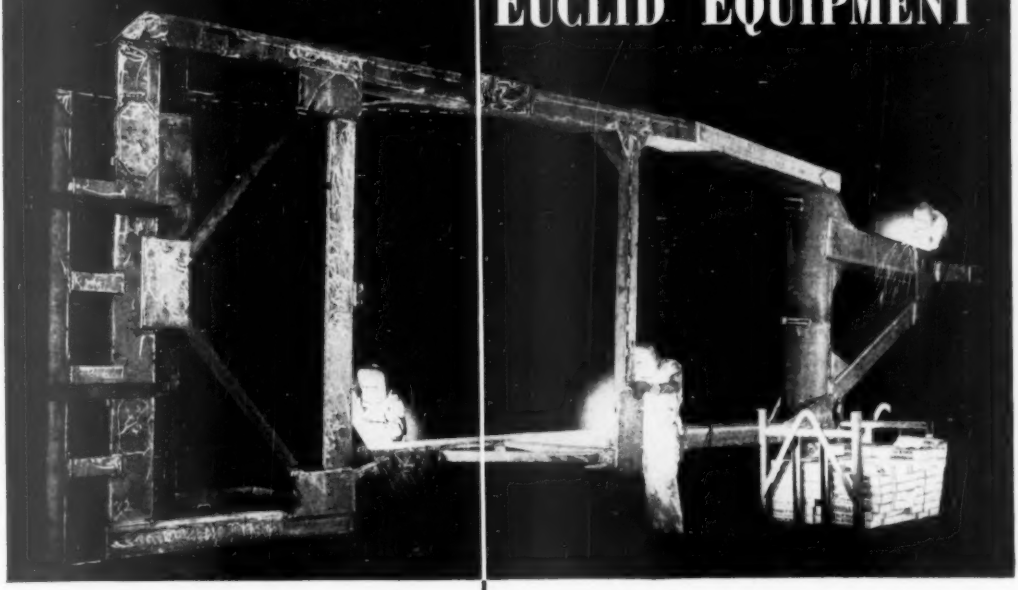
Reverse-Polarity Electrode Aids Overhead Welding

AN improved reverse-polarity d-c electrode in the E-6010 class has been designed for vertical and overhead welding of all types of joints in mild steel. The new General Electric W-22 electrode is said to have high penetration qualities which make it suitable for the welding of galvanized plate stock, lap joints and edge welds.

High strength, ductility and good impact resistance are also claimed for the weld deposit. The electrode may also be used for the repair welding of castings.

APPARATUS DEPT., GENERAL ELECTRIC CO., Schenectady 5, N. Y.

MUREX *Speeds Welding of* EUCLID EQUIPMENT



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0000000				.4900	.500		.500	0000000
000000		.5800		.4615	.469		.464	000000
00000		.5165		.4305	.438		.432	00000
0000		.4600	.454	.3938	.406	.454	.400	0000
000		.4096	.425	.3625	.375	.425	.372	000
00		.3648	.380	.3310	.344	.380	.348	00
0		.3249	.340	.3065	.312	.340	.324	0
1		.2893	.300	.2830	.281	.300	.300	1
2		.2576	.284	.2625	.266	.284	.276	2
3	.2391	.2294	.259	.2437	.250	.259	.252	3
4	.2242	.2043	.238	.2253	.234	.238	.232	4
5	.2092	.1819	.220	.2070	.219	.220	.212	5
6	.1943	.1620	.203	.1920	.203	.203	.192	6
7	.1793	.1443	.180	.1770	.188	.180	.176	7
8	.1644	.1285	.165	.1620	.172	.165	.160	8
9	.1495	.1144	.148	.1483	.156	.148	.144	9
10	.1345	.1019	.134	.1350	.141	.134	.128	10
11	.1196	.0907	.120	.1205	.125	.120	.116	11
12	10.46	.0808	.109	.1055	.109	.109	.104	12
13	.0897	.0720	.095	.0915	.0938	.095	.092	13
14	.0747	.0642	.083	.0800	.0781	.083	.080	14
15	.0673	.1571	.072	.0720	.0703	.072	.072	15
16	.0598	.0508	.065	.0625	.0625	.065	.064	16
17	.0538	.0453	.058	.0540	.0562	.058	.056	17
18	.0478	.0403	.049	.0475	.0500	.049	.048	18
19	.0418	.0359	.042	.0410	.0438	.042	.040	19
20	.0359	.0320	.035	.0348	.0375	.035	.036	20
21	.0329	.0385	.032	.0317	.0344	.0315	.032	21
22	.0299	.0253	.028	.0286	.0312	.0295	.028	22
23	.0269	.0226	.025	.0258	.0281	.0270	.024	23
24	.0239	.0201	.022	.0230	.0250	.0250	.022	24
25	.0209	.0179	.020	.0204	.0219	.0230	.020	25
26	.0179	.0159	.018	.0181	.0188	.0205	.018	26
27	.0164	.0142	.016	.0173	.0172	.0188	.0164	27
28	.0149	.0126	.014	.0162	.0156	.0165	.0148	28
29	.0135	.0113	.013	.0150	.0141	.0155	.0136	29
30	.0120	.0100	.012	.0140	.0125	.0138	.0124	30
31	.0105	.0089	.010	.0132	.0109	.0123	.0116	31
32	.0097	.0080	.009	.0128	.0102	.0113	.0108	32
33	.0090	.0071	.008	.0118	.00938	.0103	.0100	33
34	.0082	.0063	.007	.0104	.00859	.0095	.0092	34
35	.0075	.0056	.005	.0095	.00781	.0090	.0084	35
36	.0067	.0050	.004	.0090	.00703	.0075	.0076	36
37	.0064	.0045		.0085	.00664	.0065	.0068	37
38	.0060	.0040		.0080	.00625	.0058	.0060	38
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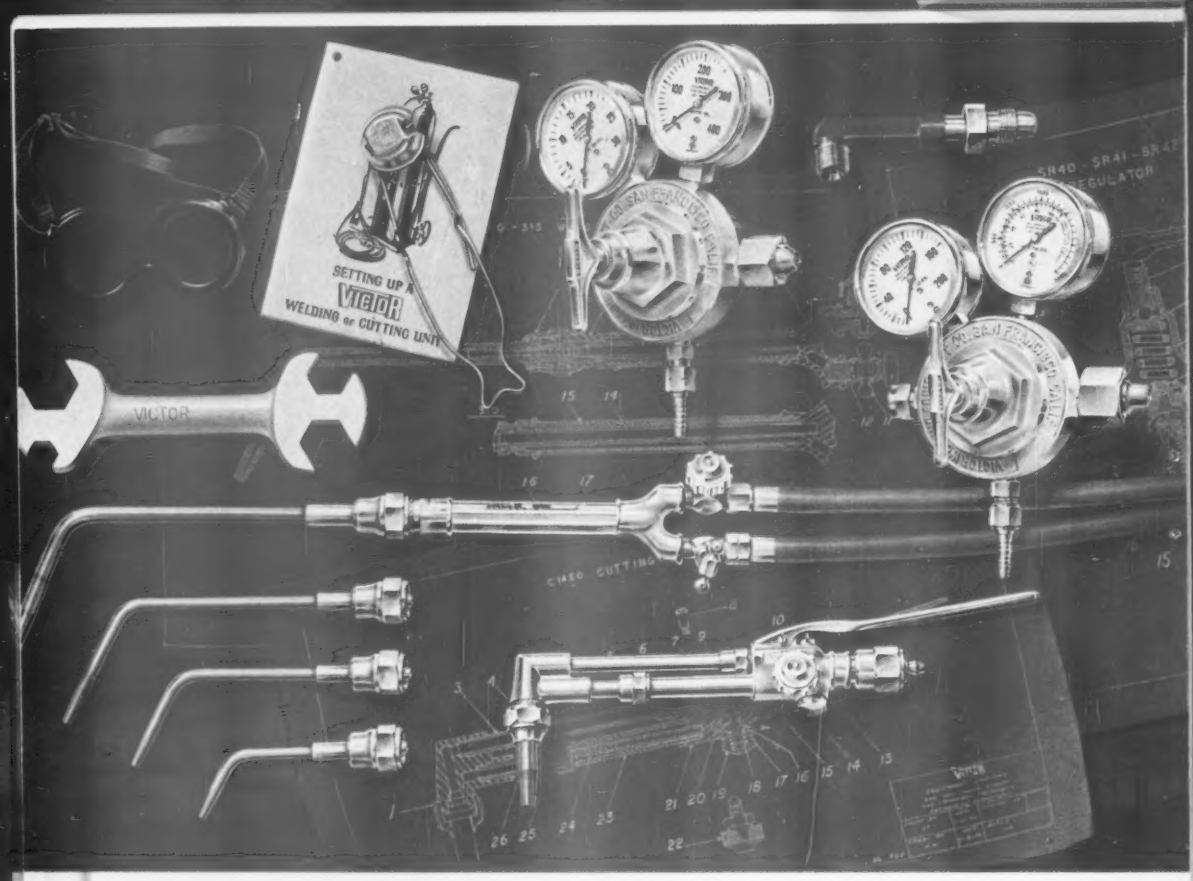

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FREE LITERATURE

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1 SUBMERGED ARC WIRE — The Reid-Avery Co., Inc., Baltimore 22, Md. 4-page, two-color bulletin describes mill finish and copper coated wire in special coils for submerged arc welding. Seven regular grades of wires are described as to analysis and diameters available. Pictures show shipping methods for tonnage lots.

2 PLASTIC COVER LENS — Universal Welding Supply Co., Chicago 43. Single-sheet bulletin describes the "Oxo" plastic cover lens for arc-welding helmets. Spatter-resistance, optical qualities and durability are discussed in detail.

3 GAS WELDING CATALOG — Dockson Corp., Detroit 8. 48-page catalog No. W-50 includes large illustrations and specifications of regulators, welding and cutting torches, soldering torches, tips, welding outfits, accessories, rods, cylinder trucks, electrode holders, helmets and goggles. Eight pages of parts diagrams have been added.

4 SILVER BRAZING — Steel Sales Corp., Chicago 23. 6-page two-color Schedule 50-A describes nine "Silvaloy" silver brazing alloys and gives their base prices. Prices for rod, coil, strip and round wire shapes are also listed.

5 MAGNETIC GROUND — Magnetrode Corp., Kansas City 8, Mo. Single-sheet bulletin and price list No. 201 gives descriptions and prices for shop, industrial and rotary models of magnetic ground clamps.

6 UNFILLED HARD-FACING TUBES — Industrial Overlay Metals, Inc. Eaton, O. Bulletin 225 describes "Dimaloy" coated unfilled electrodes for hard-facing applications. Directions for inserting carbide particles or other alloys in the tube are included. Savings made by filling "Dimaloy" tubes are compared to costs of ready-filled types.

7 ELECTRODE CATALOG—Hobart Brothers Co., Troy, O. 16-page catalog EW-149, gives applications, procedures, recommended currents, physical properties and sizes available for more than 30 Hobart electrodes. Featured are amperage tables for types and sizes of tool-and-die and stainless electrodes.

8 PORTABLE GRINDERS — The Rotor Tool Co., Cleveland 12. 24-page reprint, "How to Choose and Use Portable Tools" by H. P. Bailey, president of Rotor, includes many illustrations and data tables. Originally appearing in *American Machinist*, the comprehensive grinder article includes several sections on compressed-air supply and distribution.

9 ARC WELDERS — Air Reduction Sales Co., New York City 17. 36-page illustrated catalog includes every arc welder in the Airco line. First section deals with a-c welders, second with d-c equipment. Operating data, specifications and other pertinent features of each machine are described.

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10 ELECTRODE COMPARATOR—General Electric Co., Schenectady 5. Pocket-sized welding electrode "comparator" slide rule chart lists all G-E welding rods and electrodes and indicates the type of service for each. Competing manufacturer's electrodes are also listed for each application. Listings are keyed to AWS classification numbers. (See picture on page 66 of this issue.)

11 HEATING WALL CHART—Tempil Corp., New York City 11. Revised Tempil wall chart, "Basic Guide to Metallurgy," measures about 16 by 21 in. and is printed on glossy stock with metal guards at top and bottom. Temperatures, colors and grain structure of metal at various heats are clearly indicated.

12 SPOT WELDERS—Acme Electric Welder Co., Los Angeles 11. 4-page two-color Bulletin 50-A describes foot-operated rocker arm-type spot welders and illustrates their tip holders, horns, heat regulators, clamping devices, etc. Throat lengths, capacities and power requirements are tabulated.

13 WELDER REMOTE CONTROL—Foster Transformer Co., Cincinnati 20. Single-sheet, two-color bulletin shows handle, connector and control box elements of the Foster remote control for d-c welders. Detailed explanation is given of the control's operation and its various features.

14 WELDING FUMES—Air Reduction Sales Co., New York City 17. 12-page reprint from THE WELDING ENGINEER, "Welding and Cutting Fumes," includes both parts of this extensive review of current medical literature on welding fumes appearing in the October and November issues of this publication. An extensive bibliography of references is included.

15 POWER BRUSHES—The Osborn Mfg. Co., Cleveland 14. 24-page booklet L-265 tells how to select power brushes for cleaning welds, finishing, polishing, etc. Instructions are given for cleaning inside surfaces, removing burrs, reducing stress concentrations, to facilitate inspection, to increase effectiveness of adhesives, etc. Specifications for many Osborn brushes are included.

16 HARD-FACING ALLOY — Coast Metals, Canton, O. 8-page, two-color catalog illustrates and describes hard-facing alloys and hard cast rolls for finishing mills, sintering mills, etc. Cost comparisons between tool steel shapes and Coast metals are given in each example. Procedure sheet explains welding procedure for hard-facing batch mixer blades and includes diagrams.

17 ELECTRODE CATALOG — American Agile Corp., Cleveland 3. 24-page catalog gives identifications, descriptions, AWS classification, applications, physical properties of weld and welding instructions for mild steel, high tensile, cast iron, hard-facing, non-ferrous, tool steel and stainless steel electrodes. Cleaning tools, helmets, cable, gloves and holders are also pictured and described.

18 COVER LENSES — Flood Safety Products Co., Chicago 12. 6-page, pocket-size folder gives 12 advantages of the Flood "1000-hour" cover lenses for welding helmets. Cost saving features and the company's money-back guarantee are also described.

19 ALUMINUM-BRONZE FACING—Ampco Metal, Inc., Milwaukee 4. 4-page reprint from *The Welding Journal* titled "Cutting Maintenance Costs with Aluminum Bronze Electrodes," describes successful salvage and repair of pump shafts, gears, idlers, crane tracks and milling cutters. Author is Joseph A. Cunningham, of J. A. Cunningham Equipment Co., Philadelphia.

20 VACUUM HOSE—B. F. Goodrich Co., Akron, O. 4-page, two-color catalog section shows hose for exhausting welding fumes, types for handling dust and abrasives and designs suitable for industrial vacuum cleaners. Diameters, weight per ft, type of covering and thicknesses are tabulated.

21 GAS REGULATORS—Oxo Welding Equipment Co., Chicago 43. Single-sheet, two-color bulletin pictures and describes the "Oxo" oxygen and acetylene regulator made of stainless steel. Design of nozzle and special shield around gages are shown and explained.

22 PIPING MARKERS—W. H. Brady Co., Milwaukee 3. Three-color, Bulletin No. 144 describes and illustrates new self-adhesive markers for identifying manifold piping, conduit and tubing systems. Sample of marker is sent along with bulletin.

23 GRINDING PRACTICES — Allis-Chalmers Mfg. Co., Milwaukee. 32-page grinding standards booklet and 20-page grinding practices manual describe the company's experience with grinding wheels. Production standards, personnel responsibilities, rules, safe practices and helpful tables of data and hints are included.

24 WELDING HELMET — American Industrial Safety Equipment Co., Div. of Burdett Oxygen Co., Cleveland. 4-page, two-color bulletin shows three models of seamless welding helmets, two types of headgear and a plastic lift front glass holder. Construction features of all equipment are explained.

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1950 . . .
Our Industrial Machine Is Running Down

In his recent Economic Report to Congress President Truman chalked up a constructive advance in his economic reasoning. He pointed out that if we are going to attain the worth-while goal of a $300 billion national income in the next five years, we must equip ourselves with more and better industrial tools. Of all the dynamic forces of expansion in America, he said, one of the most important is business investment.

That is fine. It is basic common sense. We have been saying that for years and we are glad to hear the President say it too.

But having hit this new high in his economic reasoning, the President failed to draw the right conclusion. He made the mistake of accepting the false conclusion that there is no shortage of business funds to pay for more and better industrial tools. "There are immense opportunities for business investment in nearly every segment of the economy," the President said, and further, "there are in general sufficient funds available to businessmen who want to seize these opportunities."

That just is not so — and the lack is not only serious; it can well be fatal.

It is a matter of the most urgent national importance that the President's recognition of the need of more and better industrial tools should be followed by effective action. *That calls for changes in the national policies that are now blocking and, unless changed, will increasingly block business from meeting this need. If business cannot get enough new tools, the result will not be higher, but lower standards of living five years from now.*

The President should talk this matter of business investment over with Senator O'Mahoney, the Chairman of the Joint Congressional Committee on the Economic Report. Senator O'Mahoney would take to the discussion knowledge of the investment situation recently acquired through his conduct of a series of Congressional hearings.

If he told the President what he told the press during the course of these hearings, he would say, "the private capitalistic system is being seriously threatened by a lack of venture capital." That is in direct conflict with the President's conclusion that "there are in general sufficient funds available."

This serious shortage of adequate investment in new plant and equipment is brought forth so that all of us can understand it by McGraw-Hill's annual survey of American industry's plans for investment in new plant and equipment in 1950, which has just been completed.

continued on next page

BUSINESS' PLANS FOR 1950

These are the major findings of the McGraw-Hill survey of "Business' Plans for New Plants and Equipment" in 1950. Made by the McGraw-Hill Department of Economics, the survey shows:

1. Industry – as represented by manufacturing, mining, transportation, and utilities – now plans to invest $12.4 billion in new plants and equipment this year. This is 13% less than was actually spent last year.

2. Manufacturing industries alone plan to spend $6.3 billion in 1950 for new facilities. This is also 13% less than they spent last year.

3. Manufacturers as a whole expect their 1950 sales volume to about equal 1949's.

4. Manufacturers will expand their capacity about 3% in 1950, under present plans. The largest part of their funds, 65%, will go to replace and modernize existing facilities.

5. Profits and reserves are expected to provide 92% of the 1950 investment funds of manufacturing companies. These companies count on new common stock issues to provide less than one-half of one per cent of the investment funds they will need.

6. Two out of three manufacturing companies review their investment plans monthly. Almost all companies go over them at least quarterly. The survey shows that companies changed plans rapidly during 1949 to meet changes in their prospects.

7. Other industries are also reducing their investment plans in 1950 by 13%. This coincidence arises from the fact that utility companies, notably the electric light and power companies, plan to spend only slightly less than in 1949. Railroads, on the other hand, are reducing their capital programs in 1950 by more than 40%.

A copy of a complete report on "Business' Plans for New Plants and Equipment" may be obtained by writing me at McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.

The results of the survey, which are summarized above, show that American Industry – as represented by manufacturing, mining, transportation and utilities – is planning to spend 13 per cent less for new plant and equipment in 1950 than it did in 1949.

Since the rate of investment in new plant and equipment right now is apparently about 15 per cent below the rate for 1949, the present level of business investment may be relatively steady in 1950. That would relieve the fear, expressed by President Truman in his Economic Report, that "if the downward trend in business investment were to continue, our prospects for full recovery and continued expansion would be seriously endangered."

BUT, at the rate of investment planned by American manufacturing industry for 1950, it would take 40 years to modernize thoroughly our present industrial plant and equipment. That would still leave undone the job of increasing it to meet the needs of an expanding economy of the kind sketched by President Truman in his message.

In attaining even this rate of investment, the McGraw-Hill survey shows American business must rely overwhelmingly on its own profits, which have declined as the country has left the postwar boom behind it. Most American companies cannot sell new common stock except at ruinously low prices. Here is one case where government action is really needed to help business and help to keep a rising American standard of living.

In order to get enough business investment to assure the "full recovery and continued expansion" sought by the President, our country needs:

1. Lower taxes on business income so as to release more money for new plant and equipment.

2. Liberalized depreciation allowances on old plant and tools so that business can buy new equipment faster.

3. Repeal of the present double taxation of dividends which now are taxed once as corporation income and again as personal income.

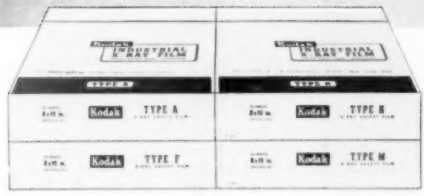
It is encouraging to have the President explicitly recognize the key importance of adequate business investment in providing steadily expanding prosperity. The next and most important thing to do is to make this recognition effective by discarding national policies which are blighting an adequate volume of business investment.

President, McGraw-Hill Publishing Company, Inc.

WHAT'S THE RIGHT X-RAY FILM?

Product:
4-inch-thick boiler drum
Material:
High tensile steel
Equipment:
1000 kv x-ray unit

ANSWER:



KODAK INDUSTRIAL X-RAY FILM, TYPE A

● To examine such a dense and thick material the radiographer takes advantage of Kodak Industrial X-ray Film, Type A. For, in order to keep exposure reasonably short, the high speed of this film is essential. At the same time, its high contrast and fine graininess enable him to take full advantage of the ability of the 1000 kv machine to detect weld irregularities.

A TYPE OF FILM FOR EVERY PROBLEM

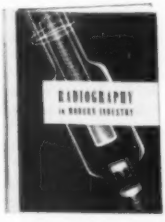
To provide the recording medium best suited to any combination of radiographic factors, Kodak produces four types of industrial x-ray film. They provide the means to check welds efficiently and thus extend the use of the welding process.

Type A—has high contrast with time-saving speed for study of light alloys at low voltage and for examining heavy parts at 1000 kv. Used direct or with lead-foil screens.

Type M—provides maximum radiographic sensitivity, under direct exposure or with lead-foil screens. It has extra-fine grain and, though speed is less than in Type A, it is adequate for light alloys at average kilovoltage and for much million-volt work.

Type F—provides the highest available speed and contrast when exposed with calcium tungstate intensifying screens. Has wide latitude with either x-rays or gamma rays, exposed directly or with lead screens.

Type K—has medium contrast with high speed. Designed for gamma ray and x-ray work where highest possible speed is needed at available kilovoltage without use of calcium tungstate screens.



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Radiography

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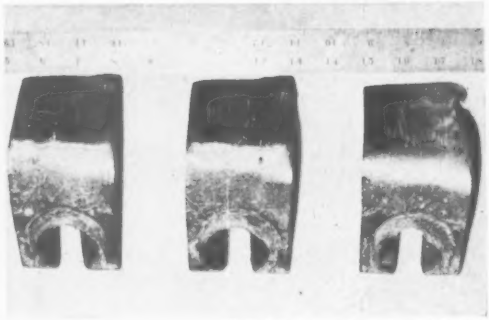
Courtesy The Linde Air Products Co.

POWDER CUTTING a laminated spill section for scrap at Pittsburgh Steel Co. Cutting is 5 to 8 times as fast as with the oxygen lance



Courtesy American Manganese Steel Division

TROWELER SHOES form or "trowel" the inner surfaces of concrete pipes. Two shoes on left were hard-faced; shoe at right was unfaced

Cutting Spills for Scrap

SLAG ladle buttons, spills and off-heat ingots are cut to furnace-charging size with speed and efficiency at the Gibsonton scrap yard of Pittsburgh Steel Company, Monesson, Pa. The world's largest cutting torch, a heavy-duty model with powder-cutting attachment, is mounted on a machine carriage. Carriage and track are in turn mounted on a gantry to make transverse cutting operations possible over the entire cutting bed. With this arrangement, scrap is loaded and unloaded without disturbing cutting operations.

In powder cutting, an iron-rich powder is blown into the cutting-oxygen stream. Slag and cinder inclusions are no problem when this type of flame-cutting is used. Sections as thick as six feet have been continuously cut. Refractory oxides are removed by a melting and fluxing action as fast as the cut is made.

Powder cutting with the specially designed heavy-duty torch is said to be five to eight times faster than cutting with the oxygen lance. Oxygen consumption per foot of cut is also much lower, it is claimed.

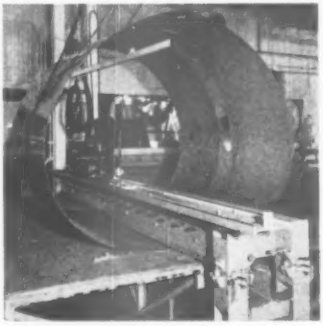
* * *

Inert-Arc Fixture for Tanks

TO TAKE full advantage of the benefits of the inert-arc process, a highly developed welding fixture was perfected by McHale Manufacturing Co., of Los Angeles, pioneer stainless-steel fabricator.

In their preliminary exploration of inert-arc welding techniques, McHale engineers concluded that a suitable jig and fixture would be necessary to apply the process profitably. After three months of research, Ted Forney, McHale's chief engineer, succeeded in developing the proper fixture to give complete versatility to the process.

It is now possible to join 12-ft sections of stainless steel in a range of thicknesses from 28-gage sheets to ¼-in. plates. The large sheets are laid upon 30-in.-high tables, then pushed into alignment over



AIR-POWERED fingers press shell plates into proper alignment for inert-arc welding

a relief groove, 3/16 in. wide by 0.007 in. deep in a copper back-up bar. A power-driven carriage moves the welding head along horizontal tracks at a speed of from 4 to 60 ipm, depending upon the type of material and its gage.

An end opening or gap permits welding of longitudinal seams with easy removal of the resulting shape. During welding, the gap is locked with a quick-acting universal fitting. Each side of the jig operates independently of the other, and both sides have metal fingers controlled by an air-pressure device which presses each finger down independently to aid in proper alignment before welding. The jig is adjustable to pressures of from 5 to 160 psi.

The inert-arc spot welding method is being used successfully in welding dimpled stock on 2-in. spacing at a rate of 12 ipm. This method is made possible by controlled gas and electrical timing. Tests of the inert-arc spot welds have shown strengths comparable to that of the parent metal.

Inert-arc welding has a decided advantage over conventional welding methods as far as stainless steel is concerned. It completely eliminates carbide precipitation, say McHale technicians.

Tungsten Carbide on Trowelers

THE STEEL blades or shoes used in "troweling" or forming the inside surfaces of concrete pipes are among the shortest lived parts in any industrial use. Rotating constantly and exerting enough pressure to squeeze moisture out of "dry-mix" concrete, troweler shoes are the victims of extreme abrasion. In the experience of Fowler & Meyers, of Somis, Calif., they had to be replaced every three hours.

As a test for wear resistance, two shoes were hard-faced with a tungsten-carbide type of welding rod while other shoes on the machine were left unfaced. The result of the test is shown in the accompanying picture. The two shoes at the left were coated; the one on the right was not. The uncoated shoe is so badly worn that it must be discarded, while the other two may be rebuilt when worn to original dimensions and returned to service. Shoes hard-faced with tungsten carbide were found to be capable of lasting a full eight-hour shift as compared with the three-hour period mentioned above for the replacement of unfaced shoes. The saving in replacement parts is considerable, and another saving occurs in production time because of the less frequent replacement of shoes.

The welding rod used for this application is a tungsten-carbide rod having carbide particles of 30-40 mesh encased in a tube of mild steel. The tube casing melts to form a matrix for the carbide, creating a wear-resistant surface. Rods are available with particles in a range of from 5-8 mesh to 40-125 mesh.

* * *

Preheating with Infrared

WELDING of high-tensile steels requires not only the employment of special electrodes and welding techniques but also a means to retain the strength of these heat-sensitive materials. The steels are particularly sensitive to heat shock when the welding is performed in cold weather. Unless great care is taken, fine cracks will develop in the weld zone.

How to overcome this heat-shock problem in naval shipyards was the research task assigned to the welding and electrical laboratory of the U. S. Naval Engineering Experiment Station at Annapolis, Md. Previously, no standard procedure had been set up.

The main consideration was to develop a more efficient method and device for preheating weld zones. Of the several methods considered, infrared heating was selected as the most practicable and economical. A wound resistor element is employed as the source of radiation.

The so-called "strip heaters" used for preheating purposes are unsatisfactory for many reasons. It takes at least four hours to preheat a 1-in. plate to 200 F. As such heaters are made of flat strips, they heat by contact only, and the heat available on the non-contact side of the strip is not utilized. Weldors find them inconvenient as they must straddle the heaters to perform their jobs. Furthermore, strip heating is expensive. It is not unusual for a shipyard to have a 5,000-kw load employed at one time for these preheating processes only.

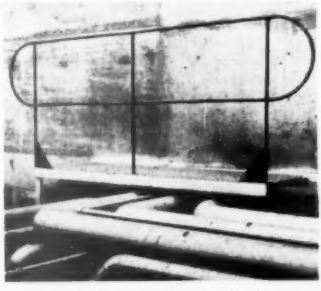
Radiant or infrared heating makes use of the principle that the heat radiated from a heat source is not dissipated in air but absorbed by the first solid body which the emanations encounter. Infrared heaters are said to be approximately twenty times as efficient as strip heaters. They are rugged, light in weight, can be instantly installed in any position through the use of their leech magnets. By assembling the units in relatively short lengths, they can be employed regardless of the curvature of the ship's structure.

Through the use of infrared or radiant heaters, the time consumed for weld overhauls and hull construction is expected to be lessened considerably and crack-proof jobs insured.

* * *

Pumper Guard

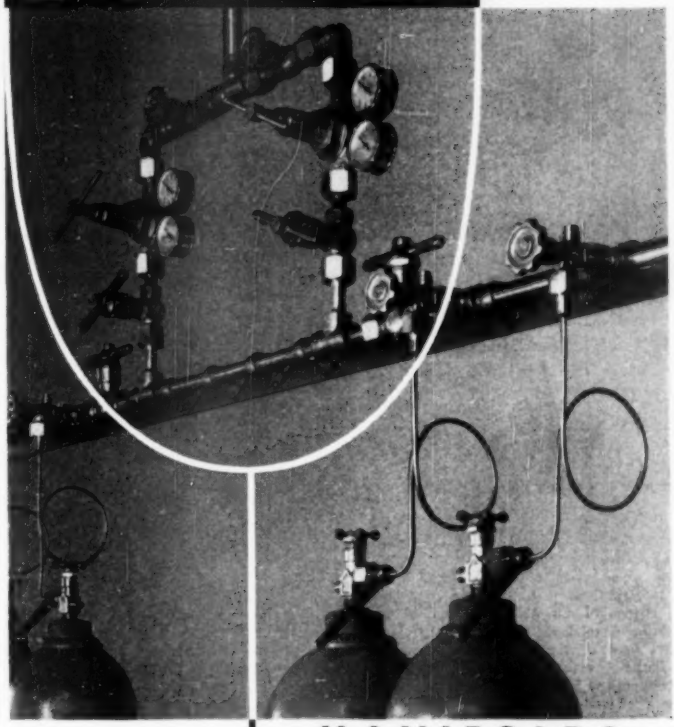
AN EFFICIENT guard to protect pumpers from injury on an oil tank-farm lease was readily constructed by welding scrap materials. Angle members make up the frame; expanded metal was used for the walkway. Discarded sucker rod was bent and welded to make the attractive handrail shown in the picture below.



Courtesy The Lincoln Electric Co.

SCRAP TUBING and angles plus a little welding made an attractive and efficient guard to protect pumpers on a tank farm

REGO*



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NEWS OF WELDING AND WELDING MEN

USED RAILS welded into 1326-ft lengths in Louisiana replace standard 39-ft rails

Pressure-Weld Used Rails on New Orleans Bridge

HUNDREDS of used 39-ft. rail lengths over the 4½-mile Huey P. Long Bridge at New Orleans were recently taken up and pressure-welded into continuous 1326-ft. lengths. These were then re-laid over the bridge. Use of the old rails reduced the original cost of the job by 80%, according to The Oxweld Railroad Service Co.

Curve-worn rails and those with bad driver burns were not welded for re-use. This culled rail was replaced by new rail, also welded into 1326 ft. strings. Alternate strings of new rail were connected to strings of old rail when laid on the bridge. A total of 427 tons of new rail were used on the bridge.

Battered ends and lengths with bolthole sections in them were removed from the used rail before welding took place. Such trimmed ends were sold as scrap. The joint fittings thereby replaced were used at other locations also or sold for scrap.

* * *

Tube Turns Subsidiary To Operate in Canada

TUBE TURNS OF CANADA, LTD., a subsidiary of Tube Turns, Inc., Louisville, Ky., will manufacture welding fittings in a modern plant at Chatham, Ontario. Special machinery and other facilities are being installed in the two-story brick building. Operations commence in March.

* * *

Organize Titanium Metals To Market Titanium

NATIONAL LEAD CO. and Allegheny Ludlum Steel Corp. have got together to form the Titanium Metals Corp., New York City, to undertake the marketing and distribution of titanium, its alloys and compounds. Officers are: H. C. Wildner, president; Clark W. King, vice-president and A. H. Drewes, secretary-treasurer.

Reducing processes and applications of titanium have been studied for many years by National Lead Co., which has now commenced larger scale production of the metal at a Sayresville, N. J., plant.

Allegheny Ludlum, which has also been conducting intensive research into melting, alloying and processing of the new metal, is now making limited quantities of titanium forgings, bar, sheet, strip and wire.

* * *

American Welding Adds Industrial Products Div.

INCREASED activity at the American Welding & Mfg. Co., Warren, O., in the welding of special steel and aluminum alloys, rings and other weldments has required establishment of an industrial products division. H. D. Malone, sales manager of the new division, will direct sales of all Amweld products except those of the railway equipment and the building products divisions.

M. R. Minnick, formerly sales manager, has been named general sales manager of the company's sales department with personal supervision of the railway equipment division.

D. W. Dawson, formerly sales promotion manager, has been named manager of the product development division and will supervise sales promotion and advertising. H. E. Gustafson retains his post as sales manager of the building products division.

* * *

General Electric Forms New Sales Division

A NEWLY organized agency and distributor division has replaced the apparatus agency division of General Electric Company's industrial divisions. George L. Irvine is manager of the new division. R. D. Moore will be assistant manager. They will be responsible for the sale of all G-E apparatus department products through agents and to distributors, wholesalers, and dealers.

* * *

New Firm Organized To Make Transformers

HIGHLAND ENGINEERING CO., Hicksville, L. I., was recently organized for the manufacture of transformers, inductors, rectifiers, power supplies and other electrical equipment. The company makes transformers ranging from 5 to 50 kva.

If This Issue is Late—

We are sorry, but mail schedules have been upset by the trains cancelled as a result of the coal strike. The editors regret this impairment of service, which is beyond our control.

COMPLETING final sections of 865-mile pipe line from Texas to Middletown, O.

865-Mile Pipe Line Goes into Operation

THE country's newest long-distance pipe line went into operation recently as Louisville Gas and Electric Company received the first delivery of natural gas from southwestern gas fields. The 26-in. transmission line, built in less than eight months at a cost of about $73,000,000, was the longest constructed and put into operation during 1949. (See "865 Mile Pipe Line," THE WELDING ENGINEER, November, 1949). It runs to Middletown, O.

Initial capacity of the line is 304,000,000 cu. ft. per day. This will be increased in 1950 to 400,000,000 cu. ft. a day. The new welded line brings additional supplies of natural gas to utility customers in Tennessee, Kentucky, Illinois, Mississippi, Louisiana and Arkansas. It is owned and operated by the Texas Gas Transmission Corp.

* * *

Cooperative Purchasing Planned By Western Welding Dealers

COOPERATIVE purchasing and the obtaining of exclusive dealerships in respective territories were the chief topics discussed at a meeting of the Independent Welding Equipment Association at the Mapes Hotel, Reno, Nev., in January. President Otto Koll, Modesto, Calif., presided.

Fifteen association members were present from dealer areas in Nevada, Arizona, Idaho, Utah, California, Oregon and Washington.

Progress has been made in obtaining exclusive sales rights in dealers' respective territories, delegates reported. Further attempts will be made to get similar arrangements with other manufacturers.

Reasons for cooperative buying of welding products in large volume were also reviewed. It was pointed out that the association membership should be limited to those who have confidence in each other along with the financial resources to purchase their share of the larger volume of products.

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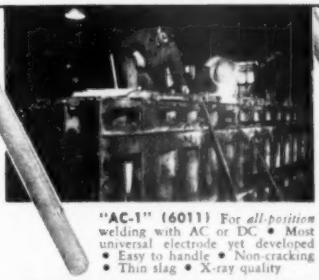
6 Ways to Beat Your Mild Steel Welding Problems

"AP" (6010) For *all-position* welding with DC • Lots of penetration • High tensile and good ductility • Quick, easy slag removal • X-ray quality



"AC-1" (6011) For *all-position* welding with AC or DC • Most universal electrode yet developed • Easy to handle • Non-cracking • Thin slag • X-ray quality

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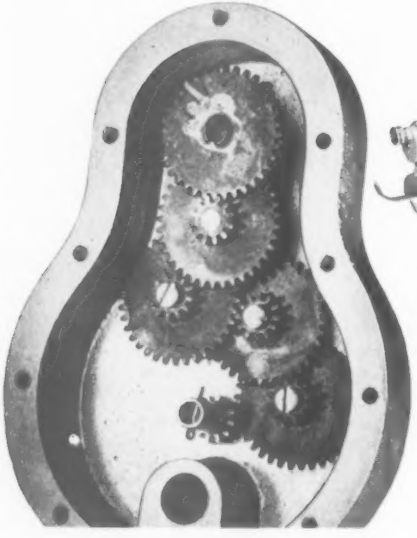
Brass gears that rotate the sprinkler pipe in the popular AVON sprinkler, were formerly attached by broaching square holes in them to fit square ends on the shafts and peening over the shaft ends. Cost was high and failures were frequent. Now, with EASY FLO 45 wire rings preplaced, gears are brazed to their shafts—in less than a minute for the whole train. Costs are way down and failures out.



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Ampco Produces R-W Alloys At West Coast Plant

FIRST volume production of RWMA Class 3 resistance welding rods west of Chicago, has been announced by R. J. Thompson, sales manager, west coast division of Ampco Metal, Inc., Burbank, Calif.

More than 1,400 lb of Class 3 rods, 4¼ in. in diameter and 50 in. long were cast, forged and then turned. More than 600 lb of Class 2 rods, 2 9/16 in. diameter and 96 in. long, were similarly produced. Most of this producton was earmarked for seam welder shafts.

Other types of resistance welding alloy castings have also been produced in the Burbank plant for auto assembly plants and welder manufacturers in the Los Angeles area.

* * *

Cut Distribution Costs, Advises J. F. Lincoln

A 40% reduction in the cost of consumer goods would result, if the same success achieved in lowering manufacturing costs could be obtained in the field of distribution, said James F. Lincoln, president of The Lincoln Electric Co., Cleveland. Speaking at a joint meeting of the Sales Executives Club and the Cleveland Advertising Club, Mr. Lincoln advocated the cutting of distribution costs as "the next great step" of industry. However, it will require the combined efforts of "all the best minds in distribution fields," Mr. Lincoln asserted.

* * *

Ryerson Finishes Addition to Chicago Warehouse

CONSTRUCTION has been completed on a brick and steel addition to the Chicago plant of Joseph T. Ryerson & Son, Inc., steel distributors. The new building provides 118,000 sq. ft. of storage and office space. It is located at 15th and Rockwell Sts. and forms a part of what is known as the north unit of the six-block long plant. Ground was broken in November, 1948.

The plant portion contains four crane-served spans and is equipped with the latest high-speed cutting saws and handling machinery.

* * *

Metallizing Contractors Meet in Detroit

THE American Metallizing Contractors Association met in Detroit, Jan. 19-21, for its annual convention and election of officers. At this time all of the previous year's officers were re-elected. They included Peter G. Dennison, president of Metal Spraying Corp., Milwaukee, association president; K. B. Smith, vice-president and general manager of the Dix Engineering Co., Detroit, vice-president; Walter B. Meyer, manager of the metallizing division, Nooter Corp., St. Louis, secretary-treasurer.

William C. Reid, formerly vice-president and sales manager of the Metallizing Engineering Co., Inc., Long Island City, N. Y., and now retired, serves as consultant to the association.

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• Whitehead Metal Products Co., Inc.

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• Brace-Mueller-Huntley, Inc.
• Whitehead Metal Products Co., Inc.

Charlotte, North Carolina
• Edgcomb Steel Company

Chicago, Illinois
• Central Steel & Wire Company
• Steel Sales Corporation

Cincinnati, Ohio
• Williams & Company, Inc.

Cleveland, Ohio
• Williams & Company, Inc.

Columbus, Ohio
• Williams & Company, Inc.

Dallas, Texas
• Metal Goods Corporation

Detroit, Michigan
• Steel Sales Corporation

Houston, Texas
• Metal Goods Corporation

Kansas City, North, Missouri
• Metal Goods Corporation

Los Angeles, California
• Ducommun Metals and Supply Co.
• Pacific Metals Company, Ltd.

Milford, Conn.
• Edgcomb Steel of New England, Inc.

Newark, New Jersey
• Whitehead Metal Products Co., Inc.

New Orleans, Louisiana
• Metal Goods Corporation

New York, New York
• Whitehead Metal Products Co., Inc.

Philadelphia, Pennsylvania
• Edgcomb Steel Company
• Whitehead Metal Products Co., Inc.

Pittsburgh, Pennsylvania
• Williams & Company, Inc.

Portland, Oregon
• Pacific Metal Company

Rochester, New York
• Brace-Mueller-Huntley, Inc.

San Francisco, California
• Pacific Metals Company, Ltd.

Seattle, Washington
• Pacific Metal Company

St. Louis, Missouri
• Metal Goods Corporation

Syracuse, New York
• Brace-Mueller-Huntley, Inc.
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Toledo, Ohio
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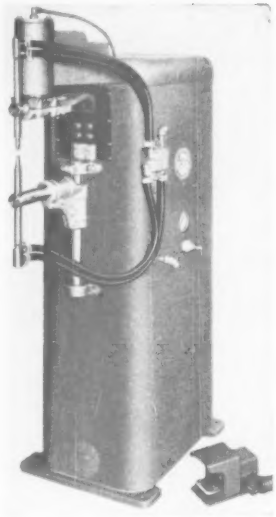
Special steel guide through the cylinder wall and piston prevents side play of the head—thus assuring clear uniform welds.

This air-operated, 15 KVA press type Spot Welder which is floor mounted, has many other distinctive features illustrated in booklet, **"Banner Welders and Brazers."**



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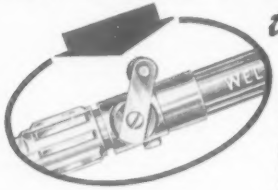

The famous MECO "On-Off" Action (above) allows a tiny pilot light to burn at the tip with the action in the "off" position. At a touch it flashes to full production flame. Action tested over 200,000 times without appreciable sign of wear.

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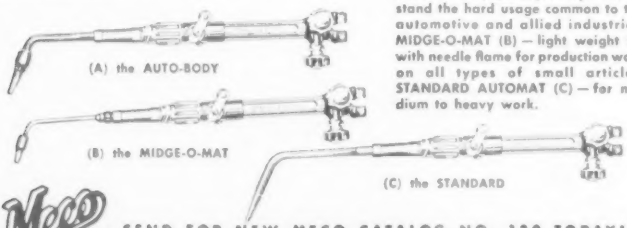

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Will Honor J. I. Banash At West Coast IAA Meeting

JAMES I. BANASH, Chicago, will receive the Morehead Medal of the International Acetylene Association at the annual convention in San Francisco's Fairmont Hotel, March 27-29. Presentation of the medal will be made by J. J. Lincoln, Jr., Air Reduction Sales Co., New York City.

A. J. Fausek, Modern Engineering Co., St. Louis, who is president of the association, will give the address at the opening luncheon session on Monday, March 27.

Co-chairmen of the Monday afternoon session will be Lee W. Delhi, past president, American Welding Society, San Francisco, and Dr. F. E. Terman, dean, school of engineering, Leland Stanford University, Palo Alto, Calif. The premiere showing of the new IAA motion picture film will be presented at this time by T. C. Fetherston and G. Van Alstyne of the IAA program, publicity and arrangements committee.

Research for the benefit of industry will be discussed by Dr. Morrough P. O'Brien, dean of engineering, University of California, Berkeley, Calif. Following Dr. O'Brien's paper, the chemical utilization of acetylene will be outlined in a paper by Dr. R. H. Ewell and Dr. L. M. Richards, Stanford Research Institute.

Tuesday morning's session will have as co-chairmen K. V. King, Standard Oil Company of California, San Francisco and R. L. Asquit, Kaiser Steel Co., Oakland, Calif. First speaker will be R. C. Wiley, welding department, California State Polytechnic College, San Luis Obispo, Calif., talking on oxyacetylene welding in agricultural and industrial college training. Construction, maintenance and repair in the gas industry will be discussed by R. D. Smith, gas engineer, Pacific Gas & Electric Co., San Francisco. Al Soderquist, Boeing Aircraft Co., Seattle, Wash., will talk on the uses of oxygen, acetylene and other gases in the aircraft industry.

James I. Banash, consulting engineer, Chicago, and W. E. Boyle, vice-president, Pelton Water Wheel Co., San Francisco, are scheduled co-chairmen for Tuesday's afternoon session. D. Saylor, chief metallurgist, Consolidated Western Steel Corp., Los Angeles, will speak on acetylene applications in steel fabricating. Use of the oxyacetylene process to reduce stresses will be the subject of a paper scheduled by Harry E. Kennedy, research associate, University of California, Berkeley, Calif. Safety practices in the use of gases will be discussed by Dr. Fennimore Davis, chief anesthetist, Peralta General Hospital, Oakland, Calif.

Wednesday morning's session will have as co-chairmen Ralph M. Hoffman, president, Pacific Division, Link-Belt Co., San Francisco, and E. A. Daniels, Victor Equipment Co., San Francisco. Production gas welding with bronze is the subject of the first paper, to be presented by C. E. Swift, sales engineer, American Brass Co., San Francisco. John Ross, Handy and Harmon, Los Angeles, will discuss low-temperature brazing. J. D. Fitzpatrick, chief metallurgist, The Kaydon Engineering Co., Muskegon, Mich., will talk on the flame hardening of bearings of unusual design.

The annual business meeting of the IAA will be held Wednesday afternoon. Election of officers and directors will take place at this time.

As an added feature of the convention, a technical discussion of matters affecting the acetylene industry will be held with Charles E. Ness, The Linde Air Products Co., Indianapolis, Ind., and F. R. Fetherston, secretary-treasurer, Compressed Gas Association, New York City, as leaders.

* * *

Aluminum-to-Copper Tubing Flash Welded

Improved percussion-welding methods now make it possible to flash-weld aluminum tubing directly to copper tubing, says Charles Bruno, welding specialist of the Reynolds Metal Co., Louisville, Ky.

The same process can also be used for joining tubing of stainless steel, Monel or other alloys to aluminum tubing without regard to the dissimilar metals in the joints.

Writing in the current issue of the Reynolds house organ, *Technical Advisor*, Mr. Bruno declares that the joining of dissimilar metals is made possible by reducing the fusion zone in the weld to less than one thousandth of an inch in width. So small is this zone that almost no intermixing of elements occurs. Another advantage is that there is no change in grain structure alongside the weld.

New applications for aluminum tubing and extruded shapes are foreseen in this development because such tubing and shapes can be welded in the heat-treated condition with very little decrease in strength through the weld zone. Since no metal is upset on the interior of the tube, refrigeration applications are expected in the near future.

Percussion welding, the process used, is an improved method of flash welding in which a high current (80,000 amp) lasting for one second is combined with a hammer blow of 20,000 psi. During the flashing period, ¼ in. of metal is burned off each piece. This metal practically all vaporizes, leaving only a few small globules inside the tube.

* * *

Lewis Welding Purchases Joy Company's Euclid, O., Plant

Lewis Welding & Engineering Corp., Bedford, O., recently purchased the Euclid, O., plant of the Joy Mfg. Co., Pittsburgh. According to J. T. Lewis, Jr., president of Lewis Welding, the new plant will be known as the Breckenridge Machine Division of the corporation. It will do machine assembly work. About 150 employees work in the new Lewis plant.

Located at 23000 St. Clair Ave., Euclid, the plant has been operated since 1946 by Joy Mfg. in the manufacture of automatic coal mining equipment. It will continue to do Joy work on a contract basis.

There will be no change in the Bedford operations of Lewis Welding, according to Mr. Lewis. The company was established in 1938 and now employs 190 men in the production of arc-welded heavy machine components for power shovels, mining machines, power presses and similar equipment.

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* Time lost in preparation, in looking for tools, in makeshift arrangements costs you money! You can't expect your men to do good work without good tools and accessories. Get the best in welding, cutting and safety equipment without paying premium prices by specifying BURDOX. Typical of the outstanding value and high quality of the entire BURDOX line are the products shown below. Made by welding men for welding men they reduce lost time, improve performance. Write for free catalog today and start saving with BURDOX at once!

CYLINDER TRUCKS DELUXE MODEL— The greatest cylinder truck value you've ever seen! Streamlined one-piece safety handle. Streamlined tool tray and rack. Bicycle type wheels with solid rubber tires. All welded construction. Chain holds cylinders securely.

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TRIP-L-ITE FLINT LIGHTERS— Lasts three times as long as ordinary lighters. Produces a hot, fat spark every time. Works easy, insures instantaneous lighting.

THE BURDOX LINE INCLUDES:

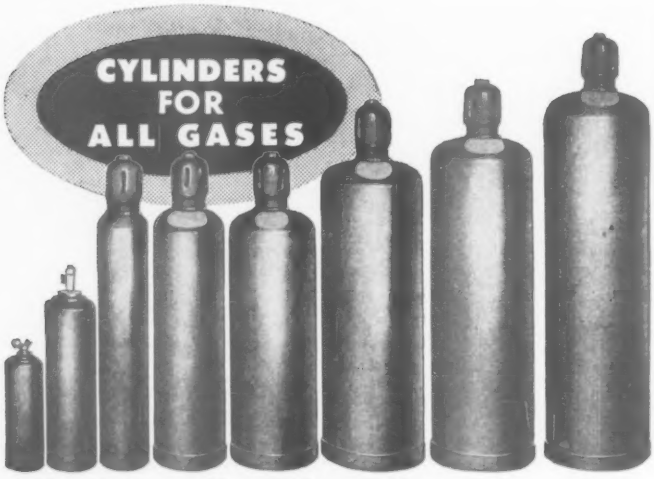
WELDING AND CUTTING EQUIPMENT AND MACHINES • SOLDERING AND BRAZING OUTFITS • INDUSTRIAL GASES • REGULATORS AND GAUGES • HOSE AND CABLE • ACETYLENE GENERATORS • GOGGLES AND HELMETS • LENSES AND FACE SHIELDS • ROD AND FLUXES • CLYINDER TRUCKS

THE BURDETT OXYGEN COMPANY

2302 LAKESIDE AVENUE GENERAL ELECTRIC CLEVELAND 14, OHIO

Arc-welding Distributor

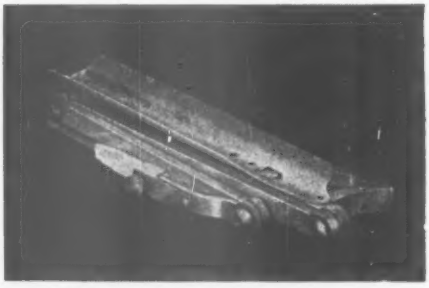
AKRON • MANSFIELD • CINCINNATI



INDEPENDENT Acetylene Cylinders take from 5 to 10% more gas. Uniformity of monolithic filler insures even distribution of acetone. Storage cylinders available in 12' and 20' lengths, of 850 and 1,500 cu. ft. capacities.

INDEPENDENT ENGINEERING COMPANY, Inc.
Manufacturers of
CONSULTING · RESEARCH · DESIGNING
CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN
O'FALLON 5, ILLINOIS

We Invite Your Inquiries



SAVE! TIME AND MONEY

SPEEDY LAYOUT JOBS ON PIPE AND STRUCTURAL STEEL

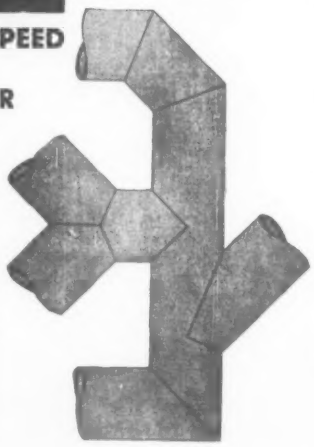
NOW! NEW EASE AND SPEED WITH THE CONTOUR MARKER

Compact, fits into hip pocket. Efficient, accurate, easy to use. Any of the angles in the illustration to the right can be marked off in five minutes or less on any pipe from 1¼ to 18 inches. Saves time, labor and gas—will pay for itself in one day.

IF YOUR LOCAL DISTRIBUTOR CANNOT SUPPLY YOU CAN ORDER DIRECT.

TO: CONTOUR MARKER CORP.
1843 E. Compton Blvd.
Compton, Calif.
Please send me full details on the Contour Marker.

NAME .....
COMPANY .....
STREET .....
CITY .....



Go to Ohio State for Info on Welding Patents

INFORMATION on more than 12,000 welding patents can be secured from the new patent classification index at the A. F. Davis Welding Library, Ohio State University, Columbus, O. Each patent is classified or indexed by process, material, product, use, inventor's name, date of issue, etc. on a single "keysort" card. The cards are sorted mechanically so that in a short time all of the patents in any given set of classifications may be selected. Most searches can be completed in from three to 20 minutes.

Information delivered will usually consist of only the patent numbers in a particular welding field. However, the patent specifications are on file in the Davis Library and may be consulted there or ordered from the United States Patent Office.

The new information service is free of charge to those who journey to Columbus to make use of the index system in person. Modest charges to defray clerical expenses will be made for inquiries handled by mail, according to Prof. Robert S. Green, acting chairman of the university's welding engineering department.

The welding patents are divided into 19 basic groups: arc welding and testing procedures; arc welding equipment; arc welding electrodes, welding rods; electrode holders, welding shields, accessories; oxy-fuel gas welding, cutting, heating and descaming; forge, furnace and Thermit welding, soldering; butt, flash, and stud welding, induction; spot, seam and projection; aircraft; containers, pressure vessels, chemical plant; electrical industry; farming industry, earthmoving, mining, links, chains, rings, bands, hoops, wheels, wire; motor vehicles, automotive industry; pipes and tubes; railroad; structural welding, furniture; watercraft and water power; miscellaneous industrial applications.

* * *

Hard-Facing Instruction For Distributor Salesmen

WALL COLMONOY CORP., Detroit, trains its distributors' salesmen in the use of Colmonoy hard-facing alloys by a special correspondence course. Lessons are sent out to the salesmen every two weeks. Many of them have written to the company, saying that the lessons have aided them in selling welding products.

While not a complete course in welding, the correspondence course contains the simple theory of welding metallurgy, hard-facing principles, metallurgical and physical properties of alloys. Colmonoy's new "spray welding" process is also explained.

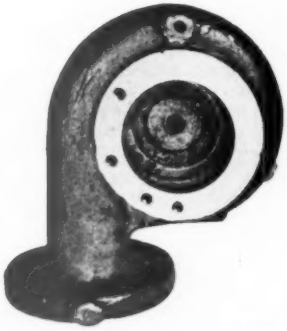
* * *

Richmond Welding Supply Co. Appointed Airco Dealer

RICHMOND Welding Supply Co., Richmond, Va., has been named an authorized dealer of Airco products. Proprietors are John G. Jones and Arnold Ruedy. Mr. Jones formerly managed the welding supply division of the Middlesex Welding & Supply Co., Inc., New Brunswick, N. J., and Mr. Ruedy was a contract hauler of petroleum gases at Petersburg, Va.

Rewarding work!

NI-ROD saves iron castings...makes *machinable* welds



But for Ni-Rod electrodes, this pump body would have been scrapped at the foundry. The built-up area of the flange facing is almost indistinguishable from the original cast iron. Machining, drilling and tapping of the Ni-Rod weld deposit were no more difficult than similar operations in cast iron.

In the photograph above, you see a 45-pound gray iron pump casing that was rejected because a small area of the flange failed to fill during pouring.

Instead of being scrapped, the casting was sent to the plant's welding department. There, with Ni-Rod® electrodes, the defective flange was built up and the repaired casting was passed to the machine shop where it was finished like a regular production piece.

Salvage operations like this with Ni-Rod save time and money.

Ni-Rod gives fast, crack-free, non-porous welds that are a close color match for gray iron . . . and welds that are as *machinable* as the iron itself. Slag removal is easy. And Ni-Rod is stable-arcing in all positions with either AC or DC current.

Another important Ni-Rod feature . . . preheating or post-heating is seldom necessary.

Why not try Ni-Rod in your own shop . . . soon? Discover for yourself why *4 out of 5 shops* re-order Ni-Rod, once they've tried it.

Your nearest INCO distributor stocks Ni-Rod in 3/32", 1/8", 5/32", and 3/16" diameters.

FREE – 8-page booklet:
"NI-ROD . . . a new electrode for any cast iron welding."

For welds you've never been able to make before . . . in high-phosphorus irons; heavy sections—

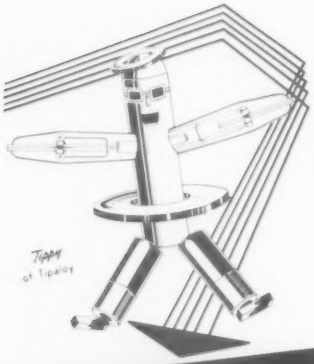
NI-ROD "55"

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
INCO NI-ROD
TRADE MARK

***NI-ROD* DISTRIBUTORS**

Alloy Metal Sales, Ltd.	J. M. Tull Metal & Supply Company	Whitehead Metal Products Company, Inc.
Robert W. Bartram, Ltd.		
Eagle Metals Company	Pacific Metals Company, Ltd.	Wilkinson Company, Ltd.
Metal Goods Corporation	Steel Sales Corporation	Williams and Company
Metal & Thermit Corporation	**National Cylinder Gas Company**	**Hollup Corporation**



Save 30%
ON YOUR
WELDING
COSTS

Tipaloy Resistance Welding Electrodes will save you 30% or more on your welding costs.

Tipaloy Electrodes have proved their superiority in countless electric resistance welding operations throughout industry. Tipaloy will give you consistently better performance, longer life, greater current density, less mushrooming, less redressing and greater continuous service under heavy production stresses.

Tipaloy Electrodes do not cost any more than the ordinary kind. They are competitively priced.

Write today for test samples and "The Story of STRAIGHT LINE Conductivity."

Tipaloy INC. 1435 E. MILWAUKEE
DETROIT 11, MICHIGAN
Offices in Principal Cities

Low-Carbon Stainless Has Good Weld Qualities

NEW low-carbon (max. 0.03%) stainless steels produced for the last several years have proved highly adaptable with most welding processes. The small amount of carbon prevents possible intergranular corrosion at the weld areas. Heretofore, it was necessary to anneal stainless weldments or use expensive "stabilized" grades to insure against such corrosion.

Armco Steel Corp. designates its steels of this type as ELC (extra low carbon) and produces them for the chemical, pulp and paper, petroleum and textile industries. Carnegie-Illinois Steel Corp., a U. S. Steel Corporation subsidiary, also produces low-carbon stainless steels claimed to have resistance to intergranular corrosion equal to 18-8 stainless.

In use more than two years, 6-ft. diameter ducts, fittings and valves of this material in a west coast paper mill have given satisfactory service despite exposure to sulphurous acid, sulphur dioxide and steam. Pickling tanks in steel fabricating plants have also been successfully tested of this material.

While a carbon content not exceeding 0.03% will prevent harmful carbide precipitation during welding, it will not insure protection at welds and in the parent metal if service temperatures are within the sensitization range of 850-1,650 F, Armco metallurgists point out. Consequently the ELC stainless steels should be specified only for welded equipment to be used at temperatures below 800 F.

* * *

Old Welder Parts Exchanged for New

OLD welder parts may be traded in for factory-wound stators, armatures and certain control parts under a new exchange plan started by Lincoln Electric Co., Cleveland 1, and pertaining only to Lincoln welders. Standard prices are said to include trade-in allowance which reduces the cost for factory parts below that usually charged for local rewinding and repairing.

This service will be provided at 146 Lincoln authorized field service shops throughout the country.

* * *

Mine Safety Appliances Starts International Division

MINE SAFETY APPLIANCES COMPANY, Pittsburgh, has established an international division to coordinate activities of its subsidiaries in Canada, South Africa and Great Britain and its export department.

C. M. Donahue will be manager of the new division in addition to his present duties as manager of the mining division. H. E. Redenbaugh will be assistant manager of the international division.

* * *

Lee Welding Opens Shop

THE Lee Welding and Mfg. Co. has opened a shop in Leetonia, O., for the fabrication of welded tanks and other products. Emery Barney is superintendent.

JACKSON
GOGGLES

• FOR WELDING
• FOR CHIPPING AND GRINDING

Jackson Goggles give adequate protection against the hazards of the jobs for which they are recommended. But to be effective they must also be worn. So we made them attractive in appearance, light and easy to wear. They are easy to adjust to any head size, and eye cups are easily fitted against the wearer's face.

The headrest type goggles, shown above, have concealed springs to hold the goggles gently against the face, and may be moved up and down with one hand.

Made in four types as shown below, the welding goggles have 50 mm. lenses in shades from 3 through 6, with cover glasses for protection. The grinding goggles have clear hardened lenses only.

JACKSON
PRODUCTS
WARREN · MICHIGAN

FOR GAS WELDING

FOR CHIPPING AND GRINDING

SOLD EVERYWHERE BY SAFETY SUPPLY DEALERS AND WELDING SUPPLY HOUSES

Omaha Welding Confab Set for March 28-30

THE annual Omaha Welding Confab staged by Omaha Welding Company, Omaha, Nebr., is set for March 28, 29 and 30, President William Schneiderwind has announced. Factory representatives and welding experts will be on hand to demonstrate the latest welding equipment and welding techniques. Films, lectures and "school" sessions will afford many educational opportunities for those present, according to company officials.

More than 1,600 people from nine midwestern states attended the 1949 Confab and an even larger crowd is expected this year. Reservations are being taken at the Castle Hotel for those wishing to attend.

* * *

Welded Boilers, Piping Discussed at Meeting

PROBLEMS met in welded boiler and piping repairs were discussed by more than 400 inspectors, contractors and insurance men at the second Chicago Safety Conference on Boilers, Unfired Pressure Vessels and Safety Attachments, held Jan. 19 at the Congress Hotel, Chicago. Sponsors of the conference were the Chicago Boiler Manufacturer's Association, the boiler and refrigeration department of the City of Chicago and the insurance companies insuring boilers in the Chicago area.

Boiler repairs from the inspector's viewpoint were discussed by P. W. Engstrom, Lumbermen's Mutual Casualty Co. Some difficulty is experienced, Mr. Engstrom reported, in getting owners to install the type of repair recommended. Improper preparation of the joint to be welded and electrodes of wrong properties are other difficulties sometimes found in repairing boilers, he said.

Certification of welders who work on high pressure piping, the various agencies and departments concerned with such instruction and qualifying and the practical results of such supervisory attempts were discussed by E. P. Everhard, William A. Pope Co.; John McCartin, United Association of Plumbers and Pipefitters; Thomas Shannon, Hartford Steam Boiler Inspection and Insurance Co.

* * *

American Brake Shoe Opens Houston Office

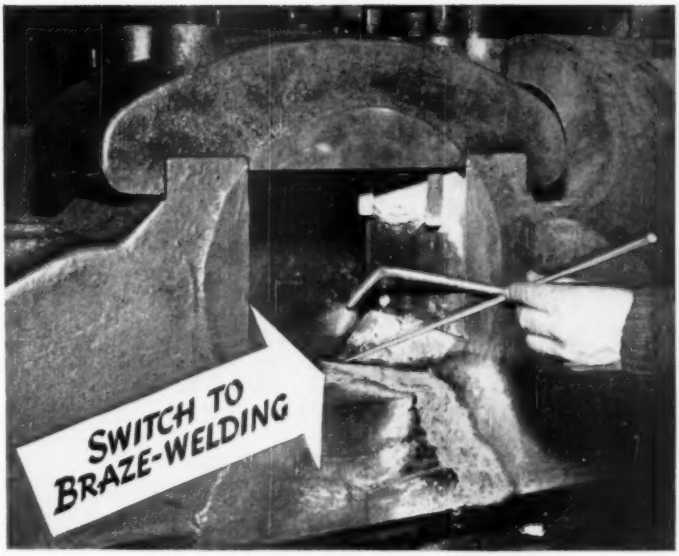
AMERICAN BRAKE SHOE CO. has opened a new sales office at 2620 Maury St., Houston, Tex., to provide more direct service to its customers in the Southwest. William C. George has been appointed sales engineer for this territory and will represent the company's American Manganese Steel, Electro-Alloys and National Bearing divisions there.

Mr. George, formerly in the sales department of Electro-Alloys division, has been with Brake Shoe since 1939.

* * *

2,000,000 Auto Bodies in 1949

MORE than 2,000,000 auto bodies were built by Fisher Body in 1949, according to J. J. Cronin, vice-president of General Motors. 1,160, 000 tons of steel were used for body parts and structures.



Weeks saved, soundness assured in repairing pump frame with

BRIDGEPORT'S No. 192 LOW FUMING BRONZE ROD

Weeks were saved in repairing this horizontal frame for a Blake high pressure pump by braze-welding with Bridgeport No. 192 Low Fuming Bronze. The strength, toughness and permanence of such repairs is attested by the fact that a previous break (lower left corner), repaired in the same manner, held under the stress that broke the opposite corner.

No. 192 Low Fuming Bronze adheres strongly to parent metal heated only to a cherry red, has good tinning action and flows freely. There's no time lost for extensive preheating, slow cooling and costly repair set-ups. Take advantage of this time-saving, money-saving repair tool. For complete information write for your copy of Bridgeport's 24-page booklet, "Bronze Welding Alloys".

"Bridgeport"

BRIDGEPORT BRASS COMPANY
Bridgeport 2, Conn. Established 1865
Mills at Bridgeport, Conn., and Indianapolis, Ind.
In Canada: Noranda Copper and Brass Limited, Montreal

Bronze Welding Rod A PRODUCT OF BRIDGEPORT BRASS

For HIGH TENSILE STRENGTH, MACHINABLE WELDS

Ask Your Distributor for

Fuse-Well

PLAIN AND ALLOY CAST IRON

WELDING RODS

ELECTRODES • MOLY RODS

- Perfect Color Match
- Like Expansion and Contraction

Fuse-Well Cast Welding Rods

CAST ALUMINUM RODS & FLUXES

THE CHICAGO HARDWARE FOUNDRY CO.

"Dependable Since 1897"

2030 Commonwealth Ave. NORTH CHICAGO, ILLINOIS

Specify CMD CHIPPING HAMMERS

— The Finest Tools Made for EVERY Weld Cleaning Need

TYPE CB . . . A favorite for many years, this hammer is 3 tools in 1—drift, chisel, and removable wire brush.

TYPE A . . . Drift and chisel of high-grade steel. Popular in malleable and grey iron foundries.

TYPES EB and FB . . . models E and F can be supplied with brush as shown here. Brush can be replaced.

TYPE E . . . head of high-grade steel has drift and chisel. Special hand grip absorbs shock.

Order from your dealer. Write today for descriptive circular W-3.

CHICAGO MANUFACTURING & DISTRIBUTING CO.

1928 WEST 46th STREET • CHICAGO 9, ILLINOIS

Workers "Give" Overtime To Help British Factory

THREE hours overtime per week without pay are being donated by 50 employees of Bristol Steel Services, Ltd., Bristlington, Bristol, England, to help their employer meet competition. Already selling prices have been lowered by 2%; 1% due to the employees extra work and 1% by management, which agreed to effect a reduction equal to that possible by the employees.

Work day of the employees now starts at 7:30 a.m., instead of the former 8 a.m. and is extended on Fridays to 5:00 p.m. instead of the usual 4:30 p.m. closing hour. The plan will be continued indefinitely.

Products of the Bristol firm are hinges, pipes, electric toaster parts, refrigerator bases, neon signs and aluminum seals for weather proofing.

• • •

Armor Research Report Includes Welding Study

DESCRIPTIONS of more than 200 research projects including a study of metal transfer in arc welding, are given in the Armour Research Foundation's annual report for the fiscal year 1948-49. The foundation is part of the Illinois Institute of Technology, Chicago. The projects discussed in the report represent an investment of more than $4,000,0000.

The basic mechanism of metal transfer and deposition in arc welding is being studied in a comprehensive program sponsored by The Lincoln Electric Co. Automatic inert-arc welding of thin-gage transformer stock and resistance welding of thin-gage metals are other welding projects being undertaken.

• • •

Beg Your Pardon!

PHOTO credit for the front cover of the December, 1949, issue of THE WELDING ENGINEER should have been given to the owner of the flame-hardening equipment pictured, the Columbia Machinery and Engineering Corp., Hamilton, O. The photo shows the flame-hardening of roller pads on a 3,400 lb. frame casting for a steam shovel.

POCKET-SIZED welding electrode "slide rule" comparator lists all of General Electric Company's welding rods and electrodes and indicates type of service for each. Principal manufacturer's electrodes which are close equivalents of G-E rods are also listed as are AWS classifications. (See Page 52.) General Electric Co., Schenectady 5, N. Y.

Lincoln Electric Reprints Welding Health Articles

THREE health and safety articles from THE WELDING ENGINEER bound into one booklet are being offered for 25c by the Lincoln Electric Co., Cleveland 1. The 16-page pamphlet contains the articles "Welding and Cutting Fumes" (2 parts) and "Health and the Weldor."

The articles on welding fumes were written by Clyde B. Clason, managing editor of THE WELDING ENGINEER, as the result of an extensive study of current medical literature. Among other facts, Clason found that welding fumes do not cause pneumonia, do not result in silicosis, do not create a tendency to tuberculosis and cannot be blamed for some other ailments commonly ascribed to them.

"Health and the Weldor," by Phil Glanzer, reviews the fume problem in conjunction with other health hazards in welding. Glanzer includes a table of minimum air requirements per weldor along with various methods of ventilation. Eye protection and skin burns are also discussed.

* * *

E. L. Mathy Joins National Welding Equipment Co.

E. L. MATHY, for many years with the Victor Equipment Co., San Francisco, has joined the National Welding Equipment Co., San Francisco, as sales and advertising counselor.

Mr. Mathy has been closely connected with industrial marketing operations for more than 30 years and has served as president of the San Francisco Sales Managers' Association and as president of the Northern California Industrial Advertisers' Association.

A former chairman of the San Francisco section of the American Welding Society, he has also been a national director of the AWS and the International Acetylene Association. His industrial experience covers more than 20 years with Victor as first vice-president and director, five years with Air Reduction and some years with his own company.

* * *

Arkansas Distributor Manufactures Oxygen

WELDERS Supply Co., Little Rock, Ark., recently commenced production of oxygen in their plant at 608 Thomas St. The plant is using a 28-meter column with a liquid pump. The firm also produces nitrogen for its customers.

FIVE TRUCKS make deliveries for Welders Supply Co., Little Rock. Oxygen, acetylene and nitrogen are produced at the plant

WELD OR CUT *Better*

with this versatile Gasweld

Registered in U. S. Patent Office

ALL-PURPOSE OUTFIT for General Work

It's ideal for job shops, garages and other places where a wide variety of welding is done. Rugged, heavy-duty torch, 17" overall, weighs 24 ounces. The WC-20 Cutting Attachment widens the utility of this handy outfit. Users find it just right for field work where portability is essential. All mixers and cutting attachments connect to the torch handle with a *neoprene seal* at the union connection.

Standard Heavy-Duty Cutting Attachment

Head mixer, tip nut and tip, needle valve, oxygen valve and lever are the same as in our standard cutting torches. This assures top cutting efficiency and rugged durability in this popular combination outfit.

WG-2544 GENERAL WELDING OUTFIT

Welding Torch is supplied with four gooseneck tips, as selected, from Nos. 1 to 6. Outfit includes: Model RO-44 Oxygen Regulator, Model RA-44 Acetylene Regulator, one pair WM-6 Goggles, two 12½-foot lengths of ¼" hose with connections, one WM-25 Safety Spark Lighter and one RF-77 Combination Wrench. One WC-20 cutting attachment and one tip.

WG-2544—Complete Welding and Cutting outfit $97.50

Welding outfit only $75.00

Write for complete catalog of welding and cutting equipment and supplies.

LISTED Underwriters Laboratories EXAMINATION SERVICE

THE LIQUID CARBONIC CORPORATION

Industrial Gas Division

3110 South Kedzie Avenue • Chicago 23, Illinois

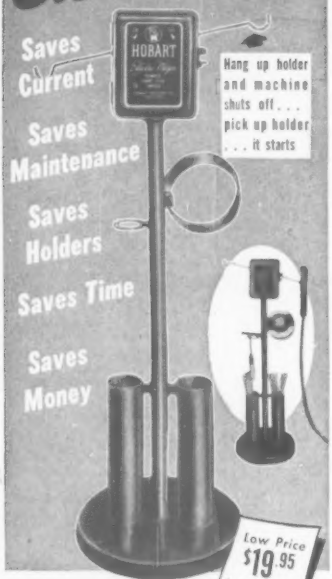
Branches and Dealers in Principal Cities

ORDER THROUGH YOUR LOCAL JOBBER OR WRITE US DIRECT

Cuts current costs 20% to 30%

HOBART

Electro-Mizer



Saves Current

Saves Maintenance

Saves Holders

Saves Time

Saves Money

This remote START-STOP SWITCH can be easily connected to any Motor-Generator welder having a push button starter.

Saves Current. When welders run idle it costs money. But Electro-Mizer shuts machines off when electrode holder is hung up on the handy hook.

Saves Maintenance. Turning the welder off when not in use saves commutators, bearings, brushes, and other parts from needless wear.

Saves Electrode Holders. Prevents breakage caused from throwing holders on the floor. Space for Rheostat, Light and Electrodes is also provided.

Saves Time and Money. Eliminates running back and forth to turn welder on and off. Results in more production. Pays you every month you use it.

HOBART BROTHERS CO., Box U-301, Troy, Ohio

HOBART "One of the world's largest builders of arc welders"

HOBART BROS. CO., Box U-301, Troy, Ohio

Prove at our risk that Electro-Mizer will save you money. Send me ____ Electro-Mizers @ $19.95.

FREE ... Send me Welder's Vest Pocket Guide

☐ Enclosed Check ☐ C.O.D. ☐ Net 30 Days

NAME

FIRM

ADDRESS

Atomic Energy Commission Releases Welding Patents

THE Atomic Energy Commission recently has made available to industry 67 patents acquired by the commission in its atomic work. These patents, owned by the government, will be licensed on a non-exclusive royalty-free basis.

Among those available are: method of welding or cutting metal by hydrogen-fluorine flame, apparatus for the storage of fluorine and production of fluorine, method of welding carbon to molybdenum, method and apparatus for producing radiographs.

* * *

W. P. & R. S. Mars Co. Issues 364-Page Catalog

WHEN a welding equipment distributor turns book publisher, that's news. W. P. & R. S. Mars Co., Duluth, Minn., have done just that by publishing a 364-page catalog (with 18 preliminary and index pages) of welding products, industrial supplies, cutting tools and machinery. The big book is clothbound (maroon), stamped with gold. It was compiled and printed by the Photologue Publishing Co., Chicago.

* * *

Welding Film Shows Eutectic Plant

NEW 16-mm sound film produced by Eutectic Welding Alloys Corp., New York City 13, shows the company's big extrusion presses at work producing electrodes. Research laboratories, chemical plant and other manufacturing facilities are also shown.

Applications of low-temperature welding rods and electrodes to castings, tool bits, motor blocks, etc. are included.

Running time of the film is 16 minutes, and it is loaned free to technical societies, welding schools, university welding courses, industrial firms, etc.

* * *

Ship-Welding Research Granted to U. of Washington

RESEARCH work on welded reinforcement around holes cut in steel ship plating will be carried on at the University of Washington under terms of a recently awarded $14,000 contract. The work will be done at the engineering experiment station at Seattle under the direction of Dr. R. A. Hechtman, associate professor of structural research.

Best shapes to cut in steel plating will also be studied. Equipment available at Washington for testing includes a tensile testing machine with a capacity of 2,400,000 lb.

* * *

1949 Aluminum Production Reached 600,000 Tons

DESPITE a prolonged strike in the final quarter of 1949, this country's aluminum production for the year exceeded 1,200,000,000 lb. according to I. W. Wilson, senior vice-president of Aluminum Company of America.

NOW Only $1.95

FORMERLY ~~2.40~~

A FAR BETTER TIP CLEANER AT MUCH LESS COST

THERMO Spiral

TIP CLEANERS GUARANTEED UNBREAKABLE

Recent improvements in quantity production of close precision manufacturing enables this substantial price reduction on Thermo Welding Tip Cleaners. No other cleaner AT ANY PRICE is guaranteed positively unbreakable in cleaning welding tips. No other cleaner cleans so efficiently, has longer life, leaves a smoother, cleaner orifice with new tip performance. No other cleaner saves so much welding tip costs for so little money. Insist on Thermo Tip Cleaners with the left-hand spiral with rounded edges, insuring better cleaning, longer lasting design.

THERMACOTE CO.

NEWARK CHICAGO — LOS ANGELES PORTLAND

Melvin Monsler Named Manager Of P&H Welding Division

MELVIN O. MONSLER has been appointed sales manager of the P&H welding division, Harnischfeger Corp., Milwaukee. Mr. Monsler has been with the company for 12 years, serving four years as assistant sales manager and one year as welding product service engineer.

Much practical welding experience was gained by Mr. Monsler while working as a weldor and an assistant to the superintendent of the P&H welding shops. Prior to joining P&H he was an instructor in welding and shop procedure, Milwaukee School of Engineering.

• • •

Aluminum Design Book Published by Reynolds

HOW TO USE extruded aluminum shapes most effectively is the theme of *Designing with Aluminum Extrusions*, a 138-page book just published by Reynolds Metal Co., Louisville 1, Ky. Author is H. V. Menking, assistant director of the company's technical service dept. Advantages of the extrusion process are broken down into eight principles of design. A section on effective extrusion design contains more than 140 illustrations showing specific applications.

Suggested connection methods which utilize the shapes afforded by extrusion are shown in 39 illustrations.

The characteristics of aluminum, selection of the correct alloy and temper, fabricating properties, finishes and cost factors are discussed in separate chapters. There are also 16 tables of data on chemical, physical and mechanical properties and process figures such as thickness, maximum lengths, tolerances, etc.

The book is 6 by 9 in. and is wirebound to lie flat when open. Copies will be sent free to engineers, architects, designers and others requesting them on company letterheads.

• • •

Vosco Named Distributor For Mir-O-Col Alloy Co.

Vosco Electric Sales Co., 11 Court St., Newtonville 60, Mass., has been appointed eastern representative of the Mir-O-Col Alloy Co., Los Angeles manufacturer of hard-facing electrodes and rods. Territory will include the states of Maryland, Delaware, Pennsylvania, New Jersey, New York and all of New England.

Officers of Vosco are Jim Vosburgh and Paul V. Galambos, both of whom have many years experience in the welding supply business.

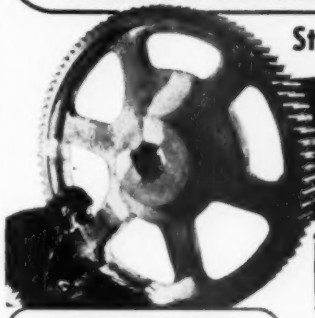
• • •

Film on Acetylene Produced by IAA

A TWO REEL, sound, color motion picture is being produced for the International Acetylene Association by Transfilm Inc., New York City. The story of the oxyacetylene welding industry will be the main theme of the production.

First showing of the film will be at the IAA convention in San Francisco on March 27, 28 and 29. It will be available for release to other organizations in April.

2½ TON GEAR FRACTURED in 5 PLACES



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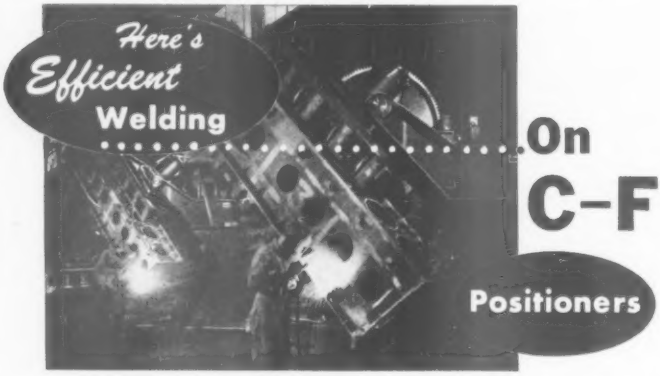

When heavy, unwieldy weldments like these diesel crank cases can be quickly swung into any position so that every weld is made **downhand**—that's efficient welding!

Weldors spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

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C-F positioned welds mean better, more economical welds

About People

KENNETH G. JOBSON, manager, cylinder maintenance and testing department of The Linde Air Products Co., was elected president of the Compressed Gas Association at the annual meeting in New York. He joined Linde in 1923 as metallurgist and has specialized on matters pertaining to compressed gas containers and other pressure vessels used by the company.

* * *

PETER G. DENNISON, president of Metal Spraying Corp., Milwaukee, has been re-elected president of the American Metallizing Contractors Association.

* * *

HARRY E. LEWIS has been named assistant comptroller of Worthington Pump and Machinery Corporation. He succeeds Joseph A. Schallenberg who died in December.

* * *

CHARLES H. GLASIER, JR., has been appointed manager of distribution for Air Reduction Sales Company, a division of Air Reduction Co., Inc. J. H. FOX was named assistant manager of distribution for the division.

* * *

CLINTON E. SWIFT has rejoined The American Brass Company, Waterbury, Conn., as a welding specialist in the company's research and promotional activities on welding rods.

* * *

OLIVER W. JOHNSON, contracting engineer, fabricated steel construction division, Bethlehem Steel Co., has been appointed manager of sales, plate construction, in the same division. HARRY B. THORN, contracting engineer in the division, has announced his retirement.

* * *

ARTHUR SCHWARZ has been appointed vice-president in charge of sales for the Nooter Corp., St. Louis. He has been with the company since 1935.

* * *

H. E. RHOADES, San Francisco manager for the National Cylinder Gas Co., has been elected chairman of the San Francisco section of the American Welding Society. Other new section officers are S. H. EDWARDS, INC., Richmond, Calif., first vice-chairman; R. E. LARAGH, Victor Equipment Co., second vice-chairman; E. W. BARTZ, Westinghouse Electric Corp., treasurer, and A. C. SCHWARTZ, Metal & Thermit Co., secretary.

* * *

W. F. BOYLE, vice-president and general manager of the Pelton Water Wheel Co., has been elected vice-president of the western district of the American Welding Society.

* * *

ROBERT F. MCKAIG has been named to the sales staff of the gold-filled division, American Silver Co., Flushing, N. Y.

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BRAZILIAN DEERSKIN
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★ **ALUMINUM SOLDER**

Special solder for aluminum—drawn or cast—lynite castings, and die-cast metals. Can be used with soldering iron or under direct flame—self fluxing.

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Every METAL BOND Product mentioned above as well as those described in our catalog can help you make more money on every welding job. These products have been used by successful welders for a great many years . . . giving them permanent good results.

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LESTER STEVENS, who works for Electrodos Monterrey, S. A., Monterrey, Mexico, visited Chicago, Cleveland, Troy, O., and other Midwestern cities in February on a business trip. He looked over new developments in welders, stud welders, compressors and other equipment his firm in Mexico handles.

* * *

DR. BORIS A. BAKHMETEFF, consulting engineer and professor of civil engineering at Columbia University, was elected chairman of the board of The Engineering Foundation, New York City. DR. A. B. KINZEL, vice-president of the Union Carbide and Carbon Research Laboratories, Inc., is a member of the executive committee of the foundation.

* * *

HARRY S. ROGERS, president, The Polytechnic Institute of Brooklyn, Brooklyn, N. Y., was elected chairman of the Engineers' Council for Professional Development.

* * *

F. P. TAUCHER has been appointed manager of engineering for the industrial control division of Westinghouse Electric Corp., Buffalo, N. Y. He has been engineering and service manager in the company's New England district for the past five years.

* * *

DR. ZAY JEFFRIES, vice-president of the General Electric Company in charge of the Chemical Department, retired on Dec. 31. He has been a pioneer and leader in the fields of chemistry and metallurgy for many years. He has served on the War Metallurgy Committee, and General Electric's 4-man committee administering the company's work on atomic energy.

* * *

HARRY L. BIALOCK, manager of sales of National Tube company at Atlanta, Ga., has been promoted to manager of sales of the tubing specialties division of this United States Steel subsidiary. He will make his headquarters at Gary, Ind., and succeeds DAVID T. MARVEL, who has resigned. CHARLES J. LUNDVALL will take Mr. Bialock's place at Atlanta.

* * *

DOUGLAS B. STEIMLE, a member of the law firm of Shearman and Sterling and Wright, has been elected a director of Air Reduction Company, Inc.

* * *

* * *

EDGAR T. LONG has joined Reynolds Metals Company as assistant product manager of the wire, rod, bar and rolled shapes division.

* * *

DAVID W. JONES, JR., Denver, Colo., will represent Lukens Steel Company and its divisions, By-Products Steel Co. and Lukenweld in the sale of steel plate and specialty plate products in Colorado, Idaho, Montana, Utah and Wyoming.

* * *

Died . . .

ROBERT JASKULEK, senior salesman and a director of the Burdett Oxygen Co., Cleveland, died on Jan. 6. He worked for Burdett more than 27 years and leaves many friends throughout his Ohio territory.

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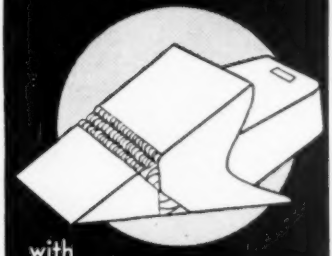

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30 YEARS AGO

(From THE WELDING ENGINEER of March, 1920)

A GIFT of more than 10,600 francs to widows and orphans of French weldors from the American welding industry and the Compressed Gas Manufacturer's Association has been announced. Seventeen families of weldors killed on the battlefield or who died as a result of accidents or disease have been awarded the money in amounts varying from 1,000 to 400 franc sums. The French Welding Society is sending a letter to the American donors thanking them for their part in this humane undertaking. The subscription fund was started by L. B. Mackenzie, editor of THE WELDING ENGINEER, C. J. Nyquist and Mr. Hume.

—30 YEARS AGO—

A Philadelphia chapter of the American Welding Society has just been organized. It is hoped that at least 1,000 members will be enrolled in this chapter.

—30 YEARS AGO—

AUTOMATIC arc welding will be performed by a new General Electric Co. machine to be put on the market soon. It is said to be two to six times as fast as manual welding and will greatly speed production of tanks and large plates.

— 30 YEARS AGO —

PAGE STEEL & WIRE CO., with mills at Monessen, Pa., and Adrian, Mich., has been purchased by The American Chain Co., Inc., Bridgeport, Conn.

— 30 YEARS AGO —

AIRPLANE delivery of a welded part for a printing press recently helped get out a newsparer on time at Nassau, in the Bahama Islands. The casting weighed 110 lb. and was welded by Carl Nobis who runs the Weathers Service Garage in Miami, Fla. Mr. Nobis is one of the country's few one-armed weldors, having lost his right arm by an accident in 1918.

— 30 YEARS AGO —

FIRST issue of *La Soldatura Autogena*, the monthly magazine of the Italian welding industry, has just come off the press.

— 30 YEARS AGO —

WELDED asemblies for a textile mill in Tientsin, China, are being produced in a Pennsylvania factory.

—30 YEARS AGO—

FOR SHIELDING the electric arc while welding superheater pipe supports, American Locomotive Co. uses a "welding box" which fits closely around the work. Colored lenses are fitted in the top of the box so that the weldor can observe the operation. Electrodes are fed by hand down through a socket in the front of the box. This method is said to shield passersby from the arc, guide the electrode better than formerly and do away with the necessity of wearing a helmet.

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For **RESULTS....**

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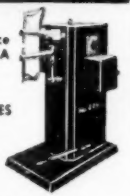

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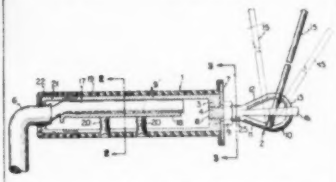
744 Broad St., Newark 2, N. J.

From the Patent Office

Electrode Holder

2,490,153. JAMES J. O'DONNELL, Somerville, Mass. Assigned one half to ARTHUR L. MCAVOY, Arlington, Mass. Filed Feb. 9, 1948. Granted Dec. 6, 1949.

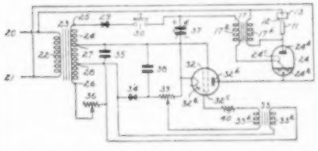


New electrode holder has means on one end for being connected to an electric cable. A loop of substantially rigid metallic material has side arms converging and joining together to close the loop adjacent the end of the handle. A tongue of the same type of material is positioned in diametrical relation to the loop and has a flat end section extending at least to the end of the loop, parallel to the plane thereof. The tongue increases in thickness towards its base and is spaced decreasingly less from the loop towards the base where it joins the loop. The tongue forms with the side converging arms an integral rod by which loop and tongue are attached to the handle.

• • •

Current Pulse Arc Welding

2,484,155. LESTER D. DRUGMAND, Greenfield, Wis. Assigned to Cutler-Hammer, Inc., Milwaukee. Filed March 27, 1948. Granted October 11, 1949.



Patent pertains to an arc welding setup consisting of a workpiece, welding electrode, source of welding current, an electronic tube and two electrical circuits. The first circuit includes in series with each other the current source, the main discharge path of the electron tube and the welding arc-gap. The second circuit includes the control electrode in the electron tube, the cathode of the tube and the arc gap. Ionization of the arc gap is a function of the current flow between the control electrode and the tube cathode. Means must be provided to impress a pulse of ignition energy upon the second circuit for initiating the flow of welding current through the first circuit.

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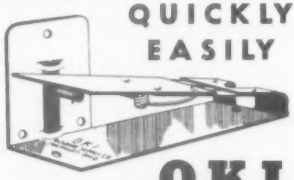

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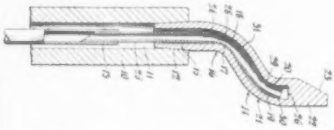
Offset R-W Electrode

2,489,993. ARTHUR F. WOOD, Indianapolis, Ind. Assigned to P. R. Mallory & Co., Inc., Indianapolis, Ind. Filed Nov. 25, 1947. Granted Nov. 29, 1949.

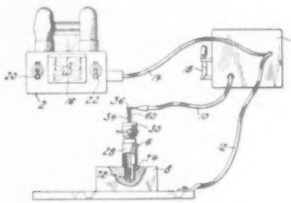


Newly patented offset welding electrode tip includes a straight portion for seating in the holder socket, a curved portion and a nose portion or welding face. The tip has a bore in it which extends through the straight, curved and nose portions. A cooling fluid conduit is mounted in the bore contiguous with and extending through the curved part of the tip.

* * *

Percussive Welding

2,485,790. WINFIELD J. TROTT, Detroit. Assigned to General Motors Corp., Detroit. Filed May 18, 1946. Granted October 25, 1949.

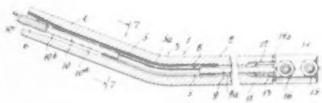


Patent pertains to a method for percussively welding two workpieces. The two workpieces are made to approach each other at appreciable speed, with a light frictional support on one of them. As they touch, discharge current from a storage condenser does the welding. A substantially constant engaging force on the weld faces is due to the frictional support of the one member.

* * *

R-W Electrode Holder

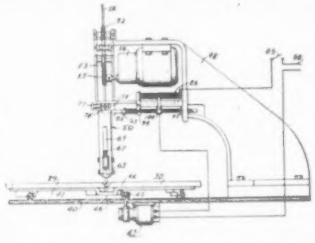
2,489,992. NORMAN ALBERT TUCKER, London, England. Assigned to P. R. Mallory & Co., Inc. Filed Oct. 28, 1947. Granted Nov. 29, 1949.



A resistance welding electrode holder comprises a shank having a longitudinal passage through it with a socket at one end for receiving an electrode. A portion of the passage is of arcuate shape to form an offset welding electrode holder. A cooling fluid conduit extends through the passage spaced from and being in gripping engagement with the shanks inside of the arcuate portion at certain points.

Automatic Arc Welding

2,490,024. ARTHUR A. BERNARD, Chicago. Assigned to National Cylinder Gas Co. Filed July 10, 1947. Granted Dec. 6, 1949.

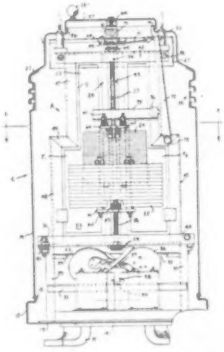


Newly patented automatic welding apparatus includes a frame, means for moving the work along a line relative to the frame, a continuous wire electrode of oblong cross section and power-driven feed rolls for feeding the wire to the work. A welding head is mounted on the frame. Contact jaws in the head have an opening of the same shape as that of the electrode for gripping it securely and for supplying welding current to it. These jaws are rotatable with respect to the line of movement to the work so that the electrode may be held in different positions to lay down welds of different widths.

* * *

Variable Output Welder

2,490,354. EDWARD A. HOBART, Troy, O. Assigned to the Hobart Bros. Co., Troy, O. Filed Oct. 22, 1947. Granted Dec. 6, 1949.



Patent pertains to a welding machine of the transformer type. A screw stem has oppositely threaded sections and a pair of core frames positioned on opposite sides of it. Each of the core frames defines upper and lower spaces, one larger than the other. A primary coil is disposed in one pair of spaces and about the screw stem. The coil is supported from one of the threaded sections. A secondary coil is in the other pair of spaces and supported from the other threaded section. Means are provided for slidably guiding the coils on the core frames and preventing rotation of the coils. Rotation of the screw stem thereby moves the coils relatively.

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17,000 "	1/8"	Arcos	25-20
50,000 "	5/32"	Mures	23-20
20,000 "	5/32"	Arcos	19-9
10,000 "	5/32"	Page	18-8
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SPOT WELDER, National, 40KVA for Brass and Stainless.
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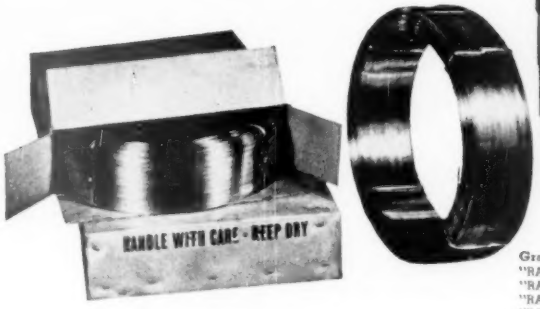

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INCORPORATED

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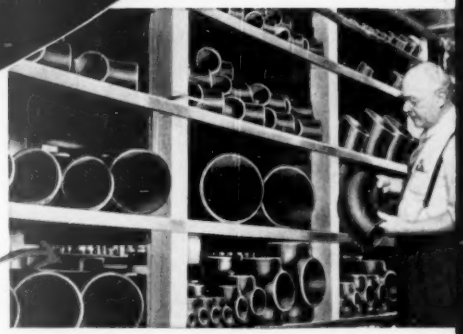

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